WAR DEPARTMENT

U. S. Dept. of Army

TECHNICAL MANUAL

NOTES FOR FIELD ARTILLERY REPLACEMENT CENTERS

March 19, 1941

FOREWORD

This manual consists of a compilation of extracts from various Field Manuals in effect on February 1, 1941, and is published primarily for use in Field Artillery Replacement Centers. It is designed as a temporary expedient to provide newly enrolled members of the Field Artillery with a compact source of certain basic essentials applicable to that arm.

In the training of the field artillery soldier, there are certain subjects peculiar to the particular arm which are not essential to a soldier of the other arms or services. In order that the new field artillery soldier may become familiar with the duties and instructions covered by these subjects, this supplement to the Soldiers' Handbook is published.

Every field artilleryman should be familiar with the history of his organization. The honor, integrity, and valor of those who carried the colors of an organization in the past stimulate the honor, integrity, and valor of those who follow in their footsteps today. We prize and jealously cherish the traditions and achievements of those whose worthy successors we would be.

TECHNICAL MANUAL

NOTES FOR FIELD ARTILLERY REPLACEMENT CENTERS

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CHANGES No. 1

WAR DEPARTMENT,
WASHINGTON, March 16, 1943.

TM 6–600, Notes for Field Artillery Replacement Centers, March 19, 1941, is rescinded.

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BY ORDER OF THE SECRETARY OF WAR:

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WAR DEPARTMENT,
WASHINGTON, *March 19, 1941.*

NOTES FOR FIELD ARTILLERY REPLACEMENT CENTERS

Prepared under direction of the
Chief of Field Artillery

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CHAPTER 1

DISMOUNTED DRILL

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SECTION I

THE BATTERY

Paragraph
To form the battery 1

1. To form the battery.—*a. 75-mm truck-drawn battery.*—(1) The first sergeant takes post 9 paces in front of the point where the center of the battery is to be, faces that point and commands: ***FALL IN.*** At the command ***Fall in,*** the battery forms as indicated in figure 1. The battery headquarters falls in on the right, in four ranks, each rank arranged in the order prescribed by the battery commander. The four gun sections fall in in numerical order from front to rear, each section arranged in the following order, from right to left: chief of section, gunner, cannoneers in numerical order, drivers (chauffeurs), automatic riflemen, and bugler (1st section). The fifth section and the maintenance section fall in on the left, fifth section in the front rank, maintenance section in the rear rank, the men in each section arranged in the order prescribed by the battery commander.

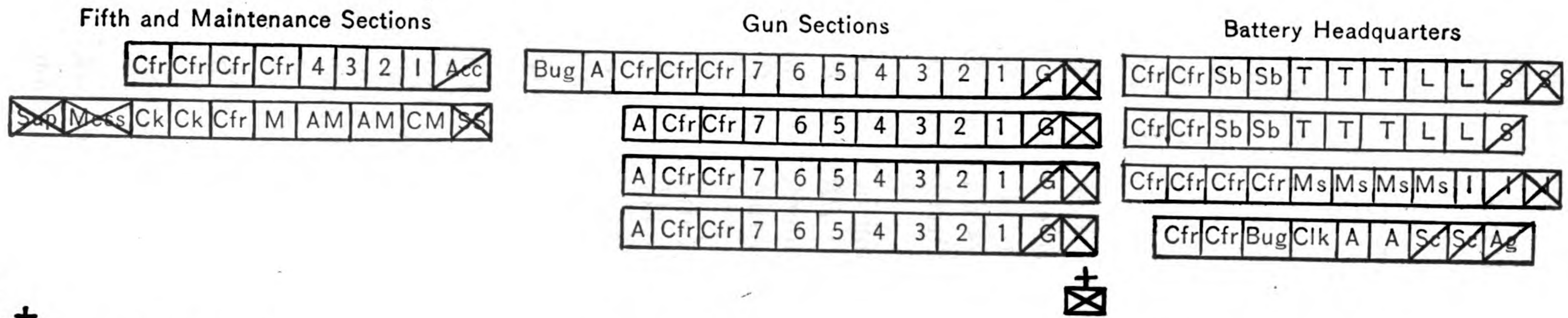
(2) Reports are not made within platoons or by platoons. At the command ***Report,*** given by the first sergeant, the senior noncommissioned officers of the various subdivisions salute and report in the following order: battery headquarters, first section, second section, third section, fourth section, fifth section, and maintenance section.

(3) For close order drill and for ceremonies, the first sergeant equalizes the strengths of the subdivisions (fig. 1), which are considered as platoons. Sufficient personnel are shifted to the fifth and maintenance sections to form a third rank, or, if it is desired to form two platoons only, these sections are broken up and the personnel attached to the battery headquarters or the gun sections.

(4) The first sergeant then designates a platoon guide for each of the platoons. No platoon sergeant or second in command is designated. As soon as the platoon guides have taken their posts the first sergeant faces to the front, salutes, and reports, "Sir, all present or accounted for," or "Sir, ———many men absent," and without command faces about and moves by the most direct route to the position shown in figure 1.

(5) The battery headquarters is commanded by the reconnaissance officer, the gun sections by the executive, and the fifth and maintenance sections by the assistant executive. The battery has no second in command.

b. Other batteries.—All other batteries and detachments form dismounted in accordance with the procedure described in *a* above.



(symbol)	1st Sergeant.
(symbol)	Sergeant.
(symbol)	Corporal.
1, 2, etc.	Cannoneers.
A	Auto rifleman.
Acc	Ammunition camouflage, and chemical.
Ag	Agent.
AM	Auto mechanic.
Bug	Bugler.
Cfr	Chauffeur.
Ck	Cook.
Clk	Clerk.
CM	Chief mechanic.
G	Gunner.
I	Instrument.
L	Lineman.
M	General mechanic.
Ms	Messenger and signalman.
S	Signal.
Sb	Switchboard operator.
Sc	Scout.
SS	Staff sergeant.
Sup	Supply.
T	Telephone operator.

FIGURE 1.

SECTION II

INSPECTIONS

Paragraph
General ---- 2
Battery inspection ---- 3
Inspection of personal field equipment while in ranks ---- 4
Battalion inspection ---- 5

2. General.—The battery is the basic unit for inspection. Battalion, regimental, and higher commanders or inspecting officers will inspect each battery in its own area or will have each battery march to a designated place at a specified time for inspection. Under special conditions an entire battalion or regiment may be formed and inspected in one large formation.

3. Battery inspection.—*a. Formation.*—The battery forms in line or in an inspection formation of column of platoons as described in paragraph 4. If transportation is to be included in the formation it forms in line 3 paces in rear or as directed. Drivers of motor vehicles remain with their vehicles. Drivers lay out their equipment as directed.

b. Procedure.—(1) The battery being in column of platoons (par. 4) the battery commander commands: ***PREPARE FOR INSPECTION.*** At this command platoon leaders cause ranks to be opened. They then place themselves, facing to the front, 3 paces in advance of the right flank of their platoons.

(2) Ranks having been opened, the battery commander commands: ***REST.*** During the inspection, officers, noncommissioned officers, and guidon bearers not in ranks come to attention as the inspecting officer approaches, and after being inspected resume the position of ***Rest.*** The battery commander may direct the second in command and/or the first sergeant to join him and take notes as he inspects. The battery commander, commencing at the head of the column, then makes a minute inspection of the arms, equipment, dress, and appearance of the personnel of the battery. As he approaches each platoon, its leader brings the platoon to attention and salutes. As soon as inspected, the platoon leader places himself on the right of the battery commander and accompanies him throughout the inspection of the platoon.

(3) The inspection is made from right to left in front and from left to right in rear of each rank.

(4) Each man executes ***Inspection arms*** as the battery commander or inspecting officer reaches his position.

(5) A man armed with the automatic rifle executes ***Inspection arms*** as the battery commander reaches his position. The inspection

completed, he pulls the trigger, replaces the magazine, and resumes the position of the soldier, the automatic rifle being slung.

(6) Enlisted men armed with the pistol execute ***Inspection pistol.*** When the battery commander has passed, they execute ***Return pistol.***

(7) Upon completion of the inspection of each platoon, its leader takes his post, faces down the line, and commands: 1. ***Close ranks,*** 2. ***MARCH,*** and adds ***Rest*** after ranks have been closed. He then takes his post in front of the center of the platoon.

(8) The battery commander may direct the platoon leaders to make the detailed inspection of arms or other equipment of the men of their platoons.

4. Inspection of personal field equipment while in ranks.— The battery forms in column of platoons (with each platoon in line) by forming extended mass formation to the right at 24 paces as follows:

a. The battery being at a halt in column of fours, the commands are: 1. ***Battery mass 24 paces left (right),*** 2. ***MARCH.*** At the command ***March,*** the leading platoon stands fast. The rear platoons move to positions alongside the leading platoon(s) at 24 paces by executing column left and column right. Each platoon is halted when the leading rank is on line with the leading rank of the platoon(s) already on the line. The battery then executes ***Left face.***

b. The battery being in march, the commands are the same as given in *a* above, except that immediately after the command ***March*** the leading platoon is halted by the commands: 1. ***Platoon,*** 2. ***HALT,*** given by its own leader. The battery commander, after the inspection of arms has been completed in a platoon, causes that platoon to take interval and prepare for inspection of equipment. Intervals having been taken, the platoon leader commands: 1. ***Unsling equipment,*** 2. ***DISPLAY EQUIPMENT.***

c. At the command ***Unsling equipment,*** each man marks with the left heel the line for the rear edge of equipment when displayed. He then unslings his equipment and places it on the ground at his feet, haversack to the front, the pack 1 foot in front of his toes.

d. At the command ***Display equipment,*** packs are opened and equipment displayed as shown in figure 2. Equipment is displayed in the interval to the left of each man. When he has finished laying out his equipment, each man resumes his original position in ranks.

e. The battery commander then passes along the ranks as before, inspects the equipment, and directs the platoon leader to have packs rolled and the platoon assembled. The platoon leader then commands: ***ROLL PACKS.***

f. Each man assembles his equipment and, leaving the equipment in its position on the ground at his feet, resumes the position of ***Attention.***

g. All equipment being assembled, the platoon leader commands: ***SLING EQUIPMENT.***

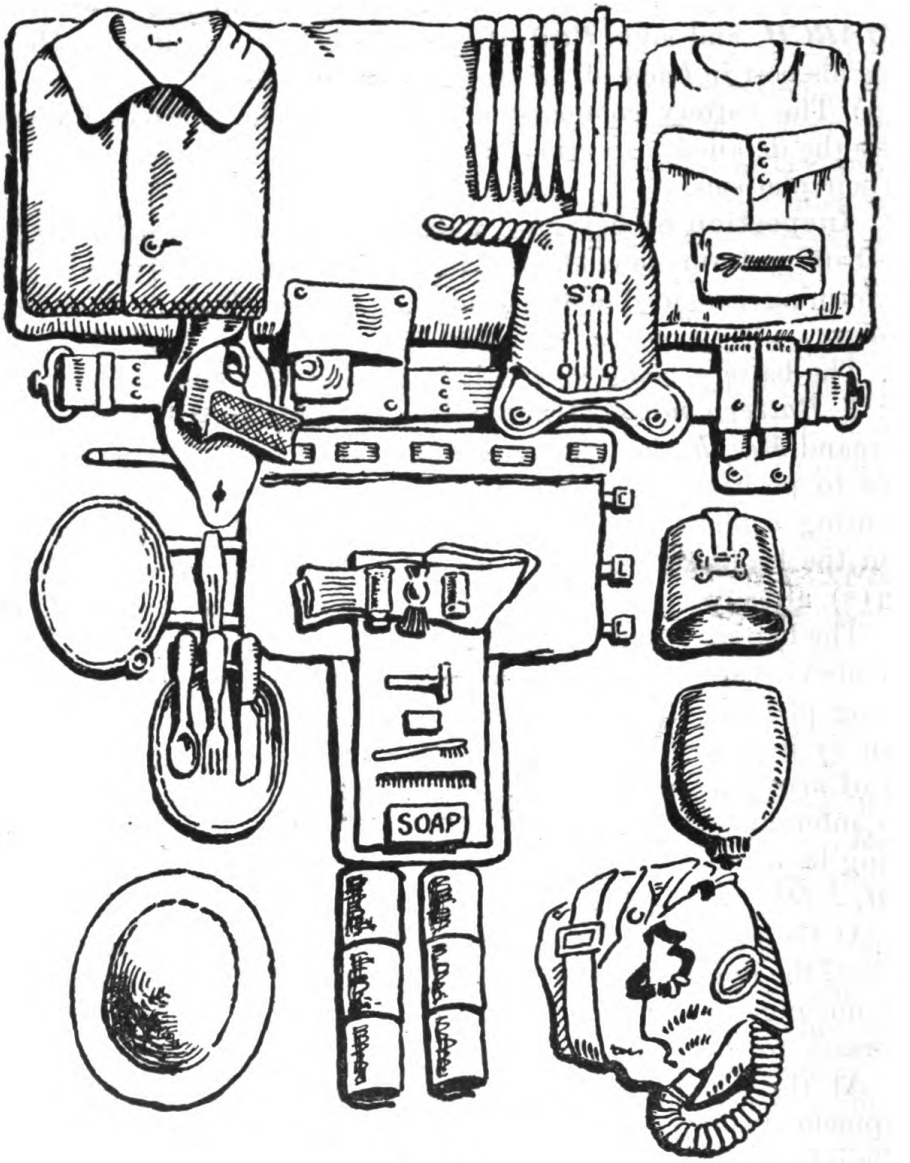


FIGURE 2.

h. Packs are slung, belts fastened, and rifles taken.

i. The platoon leader then causes the platoon to assemble. The inspection is completed as already explained.

j. In units which have special combat equipment, such as machine guns, 37-mm antitank guns, automatic rifles, and signal or command

post equipment, the battery commander, after packs have been opened (or after the individual inspection has been completed), directs "Lay out machine gun (or other) equipment for inspection." Weapons and accessories are laid out for inspection as prescribed in drill for the weapon. Headquarters personnel lay out the fire-control, communication, or other combat equipment. The gun or equipment is laid out in rear of its vehicle. If no transportation other than that drawn by hand is present, the equipment is displayed 3 paces from the flank of each squad on the side from which interval was taken. The rear of the equipment is placed on line with the rear edge of the individual field equipment.

5. Battalion inspection.—*a.* The battalion is formed in column of batteries, each battery being formed as prescribed for the battery. Any other convenient formation may be used. Before the inspection, the battalion commander indicates whether weapons and special equipment are to be laid out for inspection or left on their transportation.

b. The headquarters and weapons units are prepared and inspected in the manner prescribed for the battery.

c. The battalion being in column of platoons, with all personnel dismounted, the battalion commander commands: ***PREPARE FOR INSPECTION.*** At this command each battery and the band, if present, are prepared for inspection. Buglers rejoin their batteries. The standard bearer and the standard guard proceed to the head of the column and take position 3 paces in rear of the staff.

d. The battalion commander then commands: ***REST,*** and inspects staff and the standard guard. As the battalion commander approaches the standard guard, the standard bearer commands: 1. ***Standard guard,*** 2. ***ATTENTION.*** The standard guard may be dismissed as soon as inspected.

e. The battalion commander makes an inspection of the arms, accouterments, dress, and appearance of the personnel of the band and of the several batteries.

f. When the inspection of the band has been completed, it may be dismissed or it may take position at the rear of the column and play during the inspection.

g. As the battalion commander approaches each battery, its commander faces toward it and commands: 1. ***Battery,*** 2. ***ATTENTION,*** faces to the front, and salutes. As soon as he has been inspected, the battery commander faces about and commands: ***REST,*** and accompanies the battalion commander. The inspection proceeds as prescribed for battery inspection.

h. The battalion commander may direct the battery commanders

to make the detailed inspection of the arms or other equipment of their batteries. He may require officers of his staff to assist in the inspection, especially by checking equipment.

i. When a battery has been inspected, the battalion commander directs that it be dismissed or otherwise occupied.

j. When desired, the battalion commander may cause batteries not under inspection to fall out and resume their places in time to be inspected.

k. If the inspecting officer is an officer other than the battalion commander, the latter prepares the battalion for inspection as prescribed in the preceding paragraphs. Upon the approach of the inspecting officer, the battalion commander brings the battalion to attention, faces to the front, and salutes. The inspecting officer inspects the battalion commander who then commands: ***REST,*** and accompanies the inspecting officer. The inspection then proceeds as previously prescribed.

SECTION III

PHYSICAL TRAINING

Paragraph
Formations 6

6. Formations.—For the disciplinary and setting-up exercise, the battery forms a column of threes or fours at close interval between squads, facing the instructor, who commands:

a. 1. ***Extend to the left,*** 2. ***MARCH*** (fig. 3). At this command

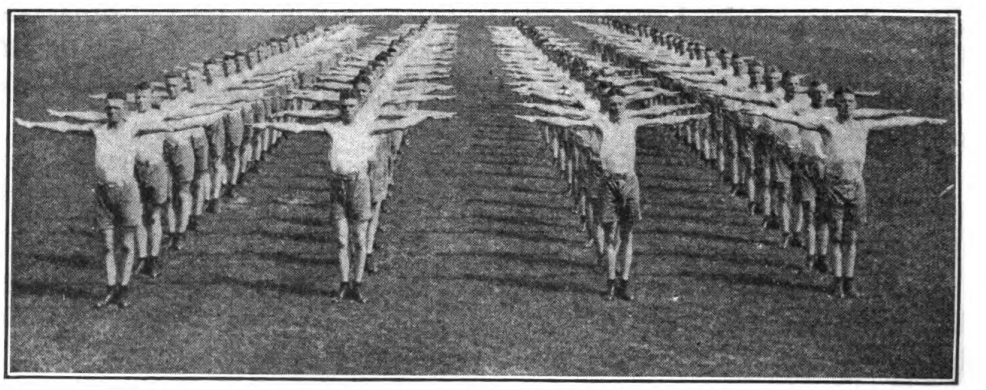


FIGURE 3.

the men in the right flank column stand fast, with arms extended sideward; all other men turn to the left and, taking up the double time, run forward to the original left: men in the center column of a three-squad unit or men in the right center column of a four-squad unit taking 2 paces; men in the left column of a three-squad unit or

men in the left center column of a four-squad unit taking 4 paces; men in the left column of a four-squad unit taking 6 paces. All face to the front with arms extended sideward after taking the required distance. The distance between finger tips is about 12 inches.

b. 1. ***Arms,*** 2. ***DOWN*** (fig. 4). At this command, the arms are lowered smartly to the side.

c. 1. ***From front to rear,*** 2. ***COUNT OFF.*** At this command the leading man in each column turns his head to the right rear, calls off "One" and faces the front. Other men in each column call off in turn, "Two," "Three," "Four," "Five," etc., in the same manner.

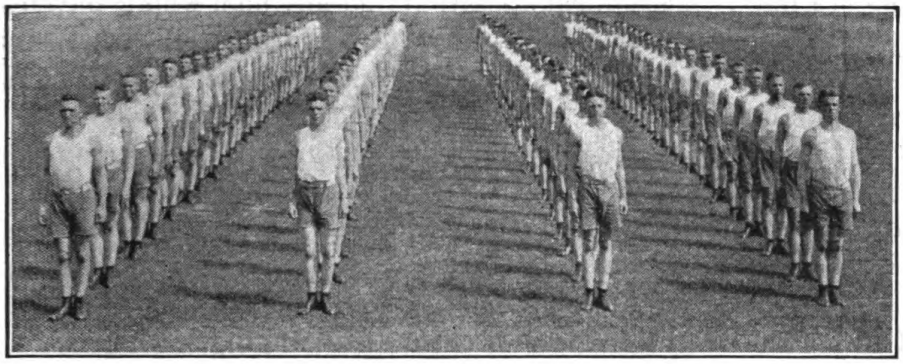


FIGURE 4.

d. 1. ***Even numbers, to the left,*** 2. ***UNCOVER*** (fig. 5). At the command, ***Uncover,*** each even-numbered man stride-jumps sideward to the left, squarely in the middle of the interval. In doing this, he swings his left leg sideward and jumps from his right foot and lights on his left foot, smartly bringing the right into position against the left.

e. 1. To assemble the unit, the instructor commands: 1. ***Assemble, to the right,*** 2. ***MARCH.*** At the command, ***March,*** all return to their original position in column on the double.

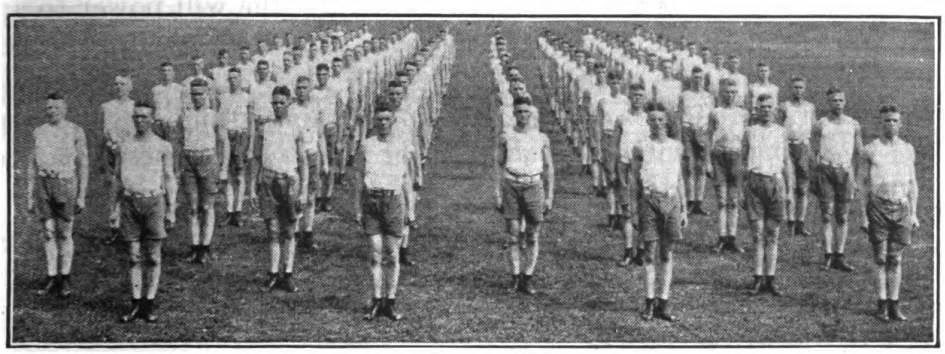


FIGURE 5.

CHAPTER 2

PISTOL MARKSMANSHIP—PREPARATORY TRAINING

	Paragraph
Instruction and practice	7
Position	8
Trigger squeeze	9
Rapid fire	10
Quick fire	11
Examination	12

7. Instruction and practice.—*a. Relative value.*—(1) Pistol firing is a purely mechanical operation that any man who is physically and mentally fit to be a soldier can learn to do well. The soldier must learn the various steps in their proper order and must carefully correct his mistakes.

(2) Good shooting is more the result of careful instruction than of mere practice. Unless properly instructed, men instinctively do the wrong thing in firing the pistol. They instinctively jerk the trigger which is the cause of flinching. Hence, practice without proper supervision fixes the instinctive bad habits.

(3) If, however, a man has been first thoroughly instructed in the mechanism of correct shooting and is then carefully and properly coached when he begins firing, correct shooting habits rapidly become fixed.

(4) The ultimate object of the training is to develop the ability to fire one or more accurate shots quickly, but training must begin with carefully coached slow fire to attain accuracy and be followed by practice that will gradually shorten the time without sacrificing the accuracy.

b. Methods of instructions.—(1) Pistol instruction is diveded into two phases, preparatory instruction and range firing. In the preparatory instruction the soldier learns practically all the fundamentals of good shooting. In range firing he cultivates the will power to apply these fundamentals when using ball ammunition until proper fixed habits have been acquired.

(2) The fundamentals of good shooting are simple and easy to learn, the trigger squeeze with the loaded pistol requiring the most practice.

(3) The six distinct steps in the preparatory instruction are—

(*a*) Aiming exercises.
(*b*) Position exercises.
(*c*) Trigger-squeeze exercises.
(*d*) Rapid-fire exercises.
(*e*) Quick-fire exercises.

(*f*) Examination on preparatory work.

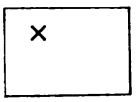
(4) The steps are progressive and must always be taught in proper sequence.

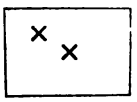
(5) Each of the first five steps begins with a demonstration by a squad which goes through the exercises that are to constitute the day's work. Then all members of the group or class are divided into pairs; the members of each pair take turns coaching one another. Every man must execute each of the exercises as it is taken up and must know its purpose and application in pistol shooting.

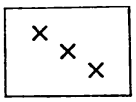
(6) Whenever time is available for a complete course of instruction and practice, the blank form shown in figure 6 must be kept by each squad leader and by each platoon leader independently. This blank

Names	Recruit instruction				Pistol marksmanship—dismounted											Remarks
	Functioning and operation	Safety precautions	Test of safety devices	Care and cleaning	Sighting bar	Exercises with the pistol rest	Holding the breath	Position of the hand	Position exercise	Trigger-squeeze exercise	Instruction in calling the shot	Rapid-fire exercise	Quick-fire exercise	Ability as a coach	Final examination	

Method of marking:


Fair.


Good.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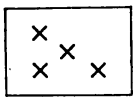
Excellent.

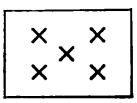
Excellent. Has instructional ability.

FIGURE 6.

form shows at a glance just how much each man knows about each feature of training and permits concentration of instruction where most needed.

(7) It is of utmost importance that the soldier have a clear understanding of how the trigger squeeze should be executed.

(8) All authorities on shooting agree that the trigger must be squeezed with a steady increase of pressure. If a man knows when his pistol will go off, it is because he suddenly gives the trigger all the

pressure necessary. On the other hand, if the increase of pressure is steady he cannot know when the pistol will be discharged. Hence, he must *squeeze the trigger in such a way as not to know just when the hammer will fall.* This does not mean that the process is necessarily a slow one and that it will take a comparatively long time to fire a shot. Through training, a man can reduce the time used in squeezing the trigger to as brief a period as 1 second and still squeeze it in such a manner that he does not know in just what part of the second the discharge will take place. When the soldier has acquired the ability to squeeze the trigger properly, even though it be very slowly, he soon learns to shorten the time without changing the process.

(9) Whenever a man is in a firing position, whether it be a preparatory instruction or during practice firing, he must have a coach beside him to watch him and point out his errors.

(10) A great deal of preparatory practice is necessary in order to strengthen the muscles of the hand and arm and to fix the habit of correct trigger squeeze. The periods of exercise will not ordinarily be of long duration. Three or four 10-minute periods per day for a month will produce good results on the range.

c. Scope of preparatory instruction.—(1) Each man closely examines his pistol for defects before the beginning of the preparatory instruction.

(2) Every man who is to fire on the range must take the preparatory course. Part of the preparatory instruction may have escaped a man the previous year and part of it has probably been forgotten, in either case it is essential to go over it again and review the subject.

(3) In peace, noncommissioned officers will take a rigid test before the period of preparatory instruction for the organization begins. This is also desirable in war when time is available.

8. Position.—*a. Essentials of proper position.*—To assume the proper position for firing it is necessary to know how to aim, how to grasp the pistol, how to hold the breath properly, and the correct position of the body with relation to the target.

b. (1) *How to grip the pistol.*—(*a*) To take the grip, hold the pistol in the left hand and force the grip safety device down and back into the crotch formed between the thumb and forefinger of the right hand. The thumb is carried parallel with or slightly higher than the forefinger; it should never be lower. Close the three lower fingers on the stock firmly but not with a tense grip (fig. 7).

(*b*) The thumb and forefinger squeeze the frame of the pistol, but the ball of the thumb will not always touch the pistol, depending on the conformation of the man's hand. By this pressure movement

to the right or left is controlled, and the trigger squeeze can be better applied and coordinated.

(*c*) The muscles of the arm are firm without being rigid. There should be no bending of the arm at the elbow when the pistol is fired.

FIGURE 7.—How to grasp pistol.

On the other hand, the arm should not be locked at the elbow. When the firer is shooting properly, the pistol arm should automatically carry the pistol back to the position shown in figure 8 after recoil.

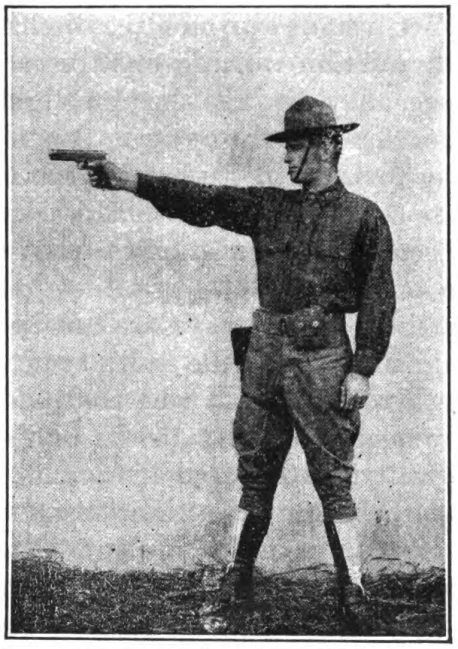

FIGURE 8.—Position of body.

(2) *How to hold the breath.*—(*a*) Instruction in the proper method of holding the breath is important, as without such instruction many men will hold the breath in the wrong way or not hold it at all.

(*b*) To hold the breath, draw into the lungs a little more air than an ordinary breath, let a little of the air out, and stop the rest by closing the throat. Do not hold the breath with the throat open or by the muscular effort of the diaphragm.

(3) *Position of the body* (fig. 8).—(*a*) The position of the body is a little more than half faced to the left; the feet 12 or 18 inches apart, depending on the man, the head erect, and the body perfectly balanced when the pistol is held in the shooting position.

(*b*) The whole position should be natural and comfortable. Upon assuming the position there is some point to which the pistol points naturally and without effort. If this point is not the center of the target the whole body must be shifted so as to bring the target into proper alinement. Otherwise the firer will be firing under a strain because he will be pulling the pistol on the target by muscular effort for each shot. Any unnecessary tensing of any of the muscles of the hand, arm, or body will cause tremors and should therefore be avoided.

9. Trigger squeeze.—*a. Importance of correct trigger squeeze.*—(1) The recruit can readily learn to aim and hold the aim, either on the bull's-eye or very close to it, for at least 10 seconds. When he has learned to squeeze the trigger in such a manner as not to spoil his hold he becomes a good shot. All men flinch in firing the pistol if they know the exact instant at which the discharge is to take place. This is an involuntary action which cannot be controlled. A sudden pressure of the trigger may derange the aim slightly, but the extreme inaccuracy of a shot fired in this way is due mainly to the flinch, that is, the thrusting forward of the hand to meet the shock of recoil. Any man who holds the sights of the pistol as nearly on the bull's-eye as possible and continues to press on the trigger with a uniformly increasing pressure until the pistol goes off is *a good shot.* Any man who has learned to increase the pressure on the trigger only when the sights are in alinement with the bull's-eye; who holds the pressure when the muzzle swerves, and who continues with the pressure when the sights are again in line with the bull's-eye is an *excellent shot.* Any man who tries to "catch his sights" as they touch the bull's-eye and to set the pistol off at that instant is a *very bad shot.* A soldier who flinches can have this fault indicated to him in a most impressive way, thereby leading to its correction, by having handed to him for each aim and trigger squeeze a pistol that may or may not have a cartridge in the chamber. By not knowing whether or not the pistol will fire when he squeezes the trigger, the soldier quickly overcomes the tendency to flinch.

(2) The apparent unsteadiness of the pistol while being held on the bull's-eye does not cause much variation in the striking place of

the bullet due to the fact that the movement is of the whole extended arm and pistol. But the sudden pressure of the trigger which always accompanies the flinch deflects the muzzle of the pistol and causes the bullet to strike far from the mark. In squeezing the trigger the pressure must be *straight* to the rear. There is a tendency on the part of some men to press the trigger also to the left.

b. Calling the shot.—To call the shot is to state where the sights were pointed at the instant the hammer fell; thus, "high," "a little low," "to the left," "slightly to the right," "bull's-eye," etc. If the soldier cannot call his shot correctly in range practice he did not squeeze the trigger properly and consequently did not know where the sights were pointed when the hammer fell.

10. Rapid fire.—Procedure in training for rapid fire is as follows:

a. The training is taken up after the trigger-squeeze exercise has been practiced sufficiently to be understood thoroughly, but the trigger-squeeze exercise practice in slow fire is resumed and continued during the entire period of preparatory training.

b. The time consumed in squeezing the trigger must necessarily be shorter in rapid fire than in slow fire, but the process is the same.

c. To fire the first shot, the pistol is brought from the position of ***Raise pistol*** by the shortest route to the aiming position with the sights alined on the mark. This is done by a smooth, rapid extension of the right arm straight from the shoulder, inserting the right forefinger in the trigger guard during the movement and holding the breath. To bring the pistol through the arc of a circle to the aiming position is an unnecessary loss of valuable time.

d. For succeeding shots the sights are held as nearly on the mark as possible and the breath held throughout the score. The recoil after each shot will throw the sights out of alinement, but they should be brought back immediately to the mark by the shortest route. The recoil should cause a vertical movement of the firing arm upward, the hand moving only 6 to 8 inches. There should be no snapping or bending of the wrist or elbow. The sights will then come back automatically on the mark after each shot. To give the pistol a flourish between shots is a useless loss of time.

e. To simulate the self-loading action of the automatic pistol, take a strong cord about 4 feet long and tie one end to the thumbpiece of the hammer, *the knot on top.* Take a few turns of the other end of the cord around the thumb or fingers of the left hand. The cord should be long enough to permit the left hand to hang naturally at the side while aiming the pistol with the right hand, right arm fully extended.

f. Each time the hammer falls, a quick backward jerk of the left

hand recocks the pistol and at the same time jerks the sights out of alinement with the bull's-eye. This derangement of the alinement corresponds very closely to the jump of the pistol when actually firing.

g. If the knot is underneath the hammer or if a very thick cord is used the hammer will not remain cocked when jerked back.

11. Quick fire.—Procedure in training for quick fire is as follows:

a. The training is taken up after the rapid-fire exercise has been practiced sufficiently to be understood thoroughly. Thereafter, exercises in slow fire, rapid fire, and quick fire are all continued until the end of the period of preparatory training.

b. For each shot the pistol is brought from ***Raise pistol*** to the aiming position by the shortest route after the target appears.

c. The pistol may be cocked after each shot in this exercise either by means of a cord as in rapid-fire exercise, or by using the left hand to pull the hammer back after the position of ***Raise pistol*** is resumed.

12. Examination.—At the completion of the preparatory instruction, the soldier should assure himself, by answering the following questions, that he understands thoroughly and can explain every phase of the preparatory training. The questions and answers are merely examples. Each man explains each item in his own words. The pistol is examined to see that it is unloaded.

Q. What are the safety devices of the pistol? *A.* The safety lock, the grip safety, the half-cock notch, and the disconnector.

Q. How do you test the safety lock? *A.* I cock the pistol, move the safety lock up into place, and then grip the stock and see if the hammer remains up when pressure is applied to the trigger.

Q. How do you test the grip safety? *A.* I cock the pistol, see that the safety lock is down and then, without putting any pressure on the grip safety, I see if the hammer will remain up when a strong pressure is applied to the trigger.

Q. How do you test the half-cock safety device? *A.* I half cock the pistol, grip the stock, and see if the hammer remains at half cock when pressure is applied to the trigger. Then I take my finger off the trigger, pull the hammer back almost to full cock, and let go of it to see if it stops at half cock as it falls.

Q. How do you test the disconnector? *A.* I cock the pistol and grip the stock; then with my left hand I move the slide to the rear a quarter of an inch; I then apply a strong pressure on the trigger and release the slide to see if the hammer will remain up. I also pull the slide fully back until it is held in place by the slide stop; I then grip the stock and apply a strong pressure down the slide stop with

my left hand. The hammer should remain up after the slide moves forward into place.

Q. If the hammer does not remain up after the slide moves forward into place, what does it indicate? *A.* That with ball ammunition the pistol would continue to fire automatically as long as pressure is maintained on the trigger, which is very dangerous.

Q. If any of the tests of the safety devices fail at any time, what will you do? *A.* I will report the matter at once to my platoon or company commander.

Q. What is the sighting bar used for? *A.* To teach men how to aim.

Q. Why is it better than a pistol for this purpose? *A.* Because the sights are much larger and slight errors can be seen more easily and pointed out.

Q. Where is the front sight?

Q. Where is the rear sight?

Q. Where is the eyepiece?

Q. What is it for? *A.* To make the man hold his head in the right place so that he will see the sights properly alined.

Q. Is there an eyepiece on the pistol? *A.* No. A man learns by the sighting bar how the sights look when properly alined, and he must hold the pistol while aiming so as to see the sights in the same way.

Q. Adjust the sights of a sighting bar so that they are in proper alinement with each other.

Q. Now that the sights are properly adjusted, move the small bull's-eye until the sights are aimed at it properly.

Q. Show how to grip the stock of the pistol.

Q. Show the position to take when you are going to shoot.

Q. How do you squeeze the trigger? *A.* I squeeze it with such a steady increase of pressure as not to know exactly when the hammer will fall.

Q. If the sights get slightly out of alinement while you are squeezing the trigger, what do you do? *A.* I hold the pressure I have on the trigger and only go on with the increase of pressure when the sights become alined again.

Q. If you do this can your shot be a bad one? *A.* No.

Q. Why? *A.* Because I cannot flinch for I do not know when to flinch, and the sights will always be lined up with the bull's-eye when the shot is fired because I never increase the pressure on the trigger except when the sights are properly alined.

Q. When you are practicing in slow fire and your arm becomes unsteady and your aim uncertain, what do you do? *A.* I come back to

Raise pistol without firing the shot and then try again after a short rest.

Q. If it is impossible for you to hold the pistol very steady, can you still do good shooting? *A.* Yes, if I squeeze the trigger properly.

Q. Tell why that is. *A.* Because the natural unsteadiness of the arm moves the whole pistol, and the barrel remains nearly parallel to the line of sight. But if I give the trigger a sudden pressure the front end of the barrel will be thrown out of line with the target, and the bullets will strike far out from the mark.

Q. What causes this deflection of one end of the pistol when the trigger is given a sudden pressure? *A.* The sudden pressure itself causes some of it, but most of it is caused by the flinch that always accompanies this kind of a trigger pressure.

Q. What do you do when you flinch in shooting a pistol? *A.* You usually thrust your hand forward as if trying to meet the shock by suddenly stiffening all your muscles.

Q. Must the trigger always be squeezed slowly in order to do it correctly? *A.* No, I squeeze it the same way in rapid fire and quick fire. The time is shorter but the process is the same.

Q. What is meant by calling the shot? *A.* To say where I think the bullet will hit as soon as I shoot and before the shot is marked.

Q. How can you do this? *A.* By noticing exactly where the sights point at the time the pistol is fired.

Q. If you cannot call your shot correctly, what does it indicate? *A.* That I did not squeeze the trigger properly and consequently did not know where the sights were pointed at the instant the discharge took place.

Q. Practice holding your breath properly while aiming.

Q. Take your pistol. Aim at a bull's-eye and squeeze the trigger a few times, calling the shot and breathe properly each time. Practice coming to a position of aim from ***Raise pistol.*** Practice coming to the aiming position in drawing the pistol from the holster in an emergency.

Q. What do you do in case a cartridge misses fire? *A.* I bring the piece to ***Raise pistol,*** grasp the slide with my left thumb and finger, pull the slide fully back, and let go of it. This throws out the faulty cartridge and loads in another cartridge.

CHAPTER 3

DEFENSE AGAINST CHEMICAL ATTACK

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SECTION I

PRINCIPAL CHEMICAL AGENTS

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13. Definitions.—*a.* A *chemical agent* is a substance useful in war which, after release and acting directly through its chemical properties, is capable of producing a toxic effect, a powerful irritant effect, a screening smoke, or an incendiary action.

b. A *persistent agent* is one which will maintain an effective vapor concentration in the air at point of release for more than 10 minutes. An effective concentration is one which necessitates protection of any kind. Some persistents last for days and even weeks.

c. A *nonpersistent agent* is one whose effectiveness in the air at point of release is dissipated within 10 minutes.

d. A *casualty agent* is a material of such physical and chemical characteristics that a dangerous or killing concentration can be set up under conditions encountered in the field. Casualty agents are therefore used directly against personnel for the primary purpose of producing casualties.

e. A *harassing agent* is one used to force masking and thus slow up enemy operations. Only those agents which produce this result with the expenditure of small quantities of ammunition are considered primarily as harassing agents. Lacrimators and irritant smokes are the principal agents of this type.

f. An *incendiary* is a chemical agent used primarily for setting fire to matériel. It may produce casualties due to heat burns.

g. A *lung irritant* is a chemical agent which, when breathed, causes irritation and inflammation of the interior portion of the bronchial tubes and lungs. Its primary physiological action is limited to the respiratory tract.

h. A *vesicant* is a chemical agent which is readily absorbed or dissolved in both the exterior and interior parts of the human body, fol-

lowed by the production of inflammation, burns, and destruction of tissue.

i. A *lacrimator* is a chemical agent which causes a copious flow of tears and intense, though temporary, eye pains.

j. An *irritant smoke* is a chemical agent which can be disseminated as extremely small solid or liquid particles in air, and when so disseminated, causes intolerable sneezing, coughing, lacrimation, or headache followed by nausea and temporary physical disability when breathed in very low concentrations.

k. A *sternutator* is an irritant smoke.

l. A *screening smoke* is a chemical agent used to blind hostile observation. With the exception of the burning action of particles of phosphorus or liquid FS on the skin, smokes have little or no injurious effect on personnel.

14. Classification.—*a. Physical state.*—Chemical agents may be encountered as gases, liquids, or solids. This classification is based on their physical condition at ordinary temperatures likely to be encountered in the field.

b. Physiological effect.—Chemical agents affect particular parts of the body in several ways. They are classified for these physiological effects as—

(1) Lung irritants.
(2) Vesicants.
(3) Lacrimators.
(4) Irritant smokes.
(5) Incendiaries.

c. Tactical use.—Chemical agents are classified in accordance with their principal tactical use as—

(1) Casualty agents.
(2) Harassing agents.
(3) Screening agents.
(4) Incendiaries.

15. Characteristics.—The tables below give in brief form the practical information on chemical agents needed in the application of defensive measures against chemical attack. The agents listed are the principal types in each class and are therefore the most likely to be used in future warfare. Since other agents that may be employed will likely be variations of these types, a knowledge of the protective requirements for the agents shown will be of considerable value in meeting any problems of protection that may arise.

LUNG IRRITANTS

Name and symbol	CHLORINE (Cl)	PHOSGENE (CG)	CHLORPICRIN (PS)
Odor	Disagreeable, pungent	Disagreeable, pungent, like new cut hay or cut corn.	Sweetish, like fly paper.
Color and state in field	Greenish yellow gas	First white, changing to colorless gas.	Oily liquid changing slowly in open to colorless gas.
Effects on body	*Lung irritant.* Causes choking and coughing, smarting of eyes, and discomfort in chest. A 2-minute exposure to an average field concentration produces a casualty. Effects begin immediately.	*Lung irritant.* Choking, coughing, hurried breathing, pains in chest due to irritation of lower lungs. Approximately nine times more toxic than chlorine; a few breaths in average field concentration produce a casualty. Effects begin immediately but progress slowly.	*Lung irritant and lacrimator.* Lacrimation, coughing, nausea, vomiting, lung irritation. Approximately one-half as toxic as phosgene.
First-aid treatment	Keep quiet and warm. Treat for bronchial pneumonia.	Keep quiet and warm; give heart stimulants; give oxygen in severe cases.	Remove to pure air. Keep quiet and warm. Give light stimulants. Wipe off splashes of liquid on skin with alcoholic disodium sulfite.
Persistency	Vaporizes almost immediately under field conditions. Drifts as gas with the wind but being heavier than air clings for some time in trenches, shell holes, woods, and other low or protected places.	Vaporizes almost immediately under field conditions. Gas remains considerable time in low or protected places.	1 to 12 hours.
Action on food and water	Contaminates. In some cases may be removed by ventilation and heating but taste remains disagreeable.	Contaminates. In some cases may be removed by ventilation and heating but taste remains disagreeable.	Contaminates. In some cases may be removed by ventilation and heating but taste remains disagreeable.
Action on metal	Dry, none; wet, vigorous corrosion.	Dry, none; wet, vigorous corrosion.	Slight tarnish only.
How used	*For casualty effects.* In cloud gas attacks as substitute for phosgene or mixed with phosgene or chlorpicrin in cylinders or Livens projectors.	*For casualty effects.* In cloud gas attack, in cylinders, projectors, medium artillery, mortars, and aviation bombs.	*For harassing and casualty effects.* In shell, bombs, or airplane spray as substitute for other agents; in like manner mixed with CN; in cloud attacks mixed with Cl.
Protection required	Gas mask	Gas mask	Gas mask.

VESICANTS

Name and symbol	LEWISITE (M1)	MUSTARD (HS)
Odor	Like geraniums, then biting	Like garlic or horseradish.
Color and state in field	Dark brown liquid, changing slowly into a colorless gas.	Dark brown liquid, changing slowly into a colorless gas.
Effects on body	*Vesicant, blisters skin.* Skin shows slight irritation in 15 minutes followed by grayish discoloration and blisters in 30 minutes to 1 hour. Systemic poisoning; vomiting. If breathed, powerful lung irritant effects within ½ hour. If unprotected, immediate irritation of eyes. Approximately six times as toxic as phosgene.	*Vesicant, blisters skin.* Symptoms delayed 2 to 4 hours. If exposed, eyes burn and inflame. Skin, in contact with gas or liquid, discolors, followed by blisters and sores. If breathed, hoarse cough develops followed by severe pain in chest and inflammation of lungs. Approximately four times as toxic as phosgene.
First-aid treatment	Wash with running water and soap, then with 5-percent aqueous solution of caustic soda followed by alcohol. Keep warm and quiet. Treatment must be given immediately. Evacuate to hospital.	Wash continuously with running water and strong soap, then apply carbon tetrachloride saturated with chlorine, or bleach solution. Wash eyes with boric acid or salt solution. Treatment must be given within a few minutes.
Persistency	Dispersed as liquid which slowly changes to gas. Rate of vaporization depends on temperature, vegetation, and method of dispersion. Rapidly destroyed by water. Summer: 24 hours in open; 2 or 3 days in woods. Winter: 1 week or more.	Dispersed as liquid which slowly changes to gas. Rate of vaporization depends on temperature, vegetation, and method of dispersion. Summer: 4 to 5 days in open; 1 week in woods. Winter: Several weeks.
Action on food and water	Poisons unprotected food and water. Cannot be made suitable for use.	Renders unprotected food and water unfit for use.
Action on metal	Very slight	Very slight.
How used	*For casualty effect* or to deny ground through threat of casualties. In artillery shell, mortar shell, airplane bombs, airplane spray, and land mines.	*For casualty effect* or to deny ground through threat of casualties. In artillery shell, mortar shell, airplane bombs, airplane spray, and land mines.
Protection required	Gas mask and protective clothing	Gas mask and protective clothing.

LACRIMATORS

Name and symbol	CHLORACETOPHENONE	TEAR GAS SOLUTION (CNS)
Odor	Like apple blossoms	Like fly paper.
Color and state in field	Bluish gray smoke from burning type munition; colorless from shell.	A colorless liquid, changing to colorless gas.
Effects on body	Piercing irritation of eyes causing profuse tears. Effective in extremely low concentrations.	Piercing irritation of the eyes, profuse tears, followed by nausea and vomiting.
First-aid treatment	Wash affected parts with water	First aid same as for lung irritant cases.
Persistency	Cloud from burning mixture drifts with wind. Will remain in low and protected places for some time. Shell or solid CN may remain several weeks.	Summer: 1 hour in open; 2 hours in woods. Winter: 6 hours in open; 1 week in woods. Dispersed as liquid which changes to gas.
Action on food and water	Gives unprotected food disagreeable odor	Contaminates. In some cases may be removed by ventilation and heating.
Action on metals	Tarnishes steel slightly	Tarnishes steel slightly.
How used	*For harassing effect.* In grenades	*For harassing effect.* In artillery shell, mortar shell, airplane bombs, and airplane spray.
Protection required	Gas mask	Gas mask.

IRRITANT SMOKES (STERNUTATORS)

Name and symbol	ADAMSITE (DM)	SNEEZE GAS (DA)
Odor	Not definite, slightly like coal smoke.	
Color and state in field	A yellow smoke cloud	Grayish smoke cloud.
Effects on body	Immediate sneezing followed by headache, nausea, and vomiting. Temporary physical debility. Effective in low concentrations but is delayed about 5 to 10 minutes.	Sneezing and burning sensation of the nose and throat. Slight lacrimation followed by occasional nausea, headache, and temporary debility. Immediately effective.
First aid treatment	Remove to pure air	Remove to pure air.

IRRITANT SMOKES (STERNUTATORS)—Continued

Name and symbol	ADAMSITE (DM)	SNEEZE GAS (DA)
Persistency	While burning, drifts with the wind, will remain in low and protected places for some time. General, 5 minutes in open	While burning, drifts with the wind, will remain in low and protected places for some time. General, 10 minutes in open.
Action on food and water	Poisons unprotected food and water; cannot be made safe for use.	Poisons unprotected food and water; cannot be made safe for use.
Action on metals	Very slight	Vigorous corrosion on steel.
How used	*For harassing effect.* In candles or generators	*For harassing effect.* In candles or shell.
Protection required	Gas mask with a good filter	Gas mask with a good filter.

SCREENING SMOKES

Name and symbol	SULPHUR TRIOXIDE SOLUTION (FS)	HC MIXTURE	WHITE PHOSPHORUS (WP)
Odor	Acid or acrid	Acrid, suffocating	Like phosphorus matches.
Color and state in field	Dispersed as liquid which changes to white smoke upon contact with air.	White smoke produced by burning munitions only.	Dispersed as solid which rapidly changes to flame and white smoke on contact with air.
Effects on body	Mild pricking sensation to skin; noninjurious.	None	Smoke, none; particles produce severe fire burns which heal very slowly.
First-aid treatment	Wash with copious amounts of water, then with sodium bicarbonate and treat as for ordinary burns.	None needed	Apply copper sulfate solution ($CuSO_4$) (2 to 5 percent). This coats the particles with copper which effectively prevents oxidation. Pull out solid particles and treat like an ordinary burn. Keep burning part under water until medical attention arrives if no $CuSO_4$ is available.
Action on food and water	Liquid renders food and water unfit for use; smoke gives disagreeable odor.	Smoke gives disagreeable odor.	Smoke gives disagreeable odor; solid is poisonous.
Action on metal	Vigorous corrosion in presence of moisture.	None, if dry	None.
How used	*Screening smoke.* In airplane spray for screening; in artillery shell, mortar shell, and cylinders for training to simulate cloud gas.	*Screening smoke.* In smoke pots or candles, for training only.	*Screening smoke* and *incendiary.* In artillery shell and mortar shell, primarily for smoke effect; also used in some munitions and airplane bombs for casualty effect and incendiary action.
Protection required	None	None	For smoke, none; for burning particles, none provided.

SECTION II

USE OF CHEMICAL AGENTS IN THE FIELD

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Conditions favorable for chemical attacks 17

16. General effects of weather and terrain on chemical attacks.—*a. Wind.*—(1) The effective use of chemical agents is largely dependent on favorable weather conditions. Chemical agents are most effective in light winds; strong winds will rapidly dissipate them. Nonpersistent chemical agents are comparatively ineffective in a wind of over 12 miles per hour. Chemical agents of the highly persistent type are not affected to the same extent by strong wind.

(2) When the enemy releases a chemical agent for a cloud attack within his own lines, the wind direction must be from the enemy to our lines. The enemy may fire chemical shell, however, on targets within our lines when the wind is in any direction. If the wind is blowing toward his own lines, the quantity of agent used will probably be small and the target area a considerable distance from his own troops.

(3) When the enemy uses a large amount of mustard gas, it may be anticipated that the gas will be directed far enough rearward in the area attacked to prevent any of the vapor drifting back over his front-line troops. For this reason, when an enemy attacks, our troops in reserve are more likely to encounter the mustard type of agent than those in the forward areas.

b. Temperature.—(1) On warm sunny days, when the temperature of the earth is higher than that of the air, ascending air currents carry the gas upward and disperse it. Warm weather increases the rate of evaporation thereby reducing the persistency of the agent. Cold weather accompanied by clouds increases persistency.

(2) Substances like mustard gas may freeze in the soil. When mustard gas freezes, it is much less effective. However, the vaporization is still sufficient, except in subfreezing weather, to produce casualties if personnel are exposed for a considerable period. It must be kept in mind that solid particles of frozen mustard gas may become attached to clothing while passing through undergrowth and these particles will cause burns if they come in contact with the body.

c. Fog and rain.—Foggy and cloudy weather is favorable for the use of gas. Rainfall tends to wash gas out of the air and in most cases slowly destroys liquid on the ground.

d. Night.—The most favorable conditions for the use of gases, particularly those of the phosgene type, occur at night or in the early morning, because strong winds and ascending currents are then usually absent. Furthermore, there is the possibility of effecting surprise on sleeping men.

e. Ground.—(1) *Surface.*—The most important effects of the ground on chemical agents in liquid form are as follows:

(*a*) Soft dry ground will absorb liquids and so reduce the danger from direct physical contact. It is difficult to detect vesicant gas, however, when absorbed in earth.

(*b*) On soft wet ground, gas may persist for considerable periods as free and unabsorbed liquid. Where shell or bombs burst on soft ground, a large proportion of the liquid content will be absorbed or buried in the crater, contaminating earth or mud. When boots or shoes become contaminated with liquid mustard gas and are later worn in inclosed places, such as a billet or dugout, dangerous vapor concentrations may arise.

(*c*) On hard ground, the liquid contents of chemical projectiles are scattered over a relatively large area. Hard ground retards penetration of liquid agents released in this manner; consequently, the agents are exposed in greater degree to the influence of wind, sun, and rain, thus lessening their persistency yet increasing the gas hazard.

(2) *Topographical features.*—All chemical agents successfully used in warfare are heavier than air. Unless set in motion by wind or air currents, gas clouds tend to flow into gullies and valleys, leaving the tops of hills comparatively free.

(3) *Vegetation and obstructions.*—Tall grass, bushes, trees, buildings, and similar obstructions retard the movement of the air and in like manner the movement of vapors of chemical agents, thereby making them more persistent. Tall grass and undergrowth increase the danger from vesicants.

17. Conditions favorable for chemical attacks.—*a. Situations in which an enemy may use nonpersistent gas.*—(1) Between midnight and sunup, when ground temperature is lower than air temperature and troops are least alert.

(2) When wind velocities are between 3 and 12 miles per hour.

(3) When wind direction is either from the enemy or parallel to the front.

(4) On troops, particularly large concentrations, located in low ground or in woods.

(5) On foggy, overcast days.

b. Situations in which an enemy may use persistent gas.—(1) Against strong points and centers of resistance which would be very difficult for the enemy to capture by assault and which he does not expect to occupy or pass through.

(2) In defiles.

(3) On terrain surrounding approaches to fords, bridges, and on beaches.

(4) On artillery firing positions.

(5) On distributing points, airdromes, bivouac areas, railheads, marching troops, and supply columns, especially by spraying from attack aviation.

(6) On a withdrawal by the enemy, he may be expected to leave bands of persistent vesicants in front of or within his former position and on routes that are likely to be used by pursuing forces.

(7) On important routes of approach.

c. Situations in which an enemy may use incendiaries.—(1) Against villages of largely frame construction.

(2) Against army depots, airdromes, and large supply centers well to the rear where inflammable supplies, such as ammunition and forage, are stored in large quantities.

(3) Against position located in dry grain fields or woods, when the wind direction is from the enemy.

SECTION III

PROTECTION AND PROTECTIVE EQUIPMENT

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Gasproof shelters	20
Collective protector	21
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Decontamination	23
Protection of food and water supplies	24
Protection of supplies, equipment, and munitions	25

18. Classification of protective measures.—Protection against gas attacks presents three classes of problems: individual, collective, and tactical. The first two involve protective measures of a generally passive nature; that is, principally the provision and use of protective equipment and installations. The third concerns modes of action and troop leading with a view to avoiding gas casualties in the conduct of military operations. These three forms of protection may be briefly outlined as follows:

a. Individual.—Individual protection includes not only the proper distribution, use, and care of protective equipment but also ability to recognize the presence of a particular chemical agent; and, by knowing its characteristics, to utilize equipment in such a manner as to avoid becoming a casualty.

b. Collective.—Collective protection is the utilization of measures and unit protective equipment for the protection of personnel, animals, and matériel. It includes the posting of gas sentries, operation of gasproof shelters, measures to insure the preservation of animals and equipment, and the use and decontamination of protective covers.

c. Tactical.—Tactical protection includes such activities as chemical reconnaissance, chemical intelligence, selection of routes of march, camp sites, and battle positions; protective disposition of troops; schemes of deployment of units; maneuver to avoid gassed areas; and offensive action to forestall or disrupt the enemy's chemical operations.

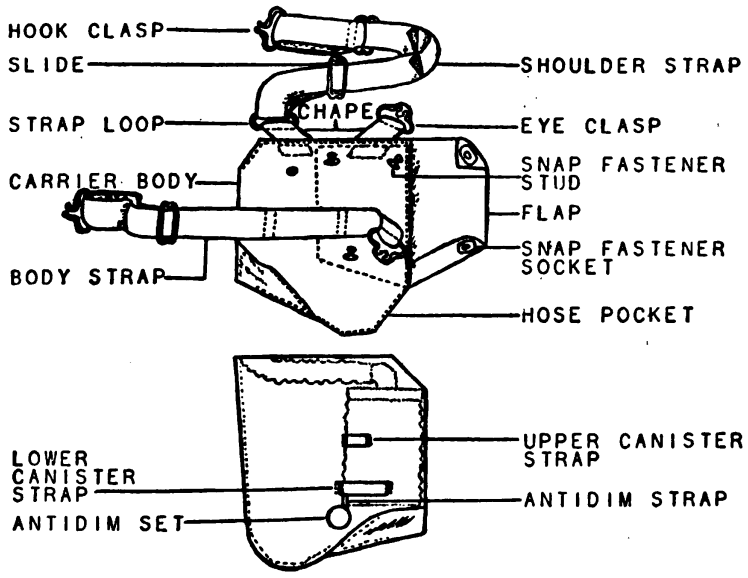
19. Protective clothing.—Protective clothing, which is designed for the protection of the body against gases of the mustard type, will be issued in time of war.

20. Gasproof shelters.—It is possible to subject extensive areas to lethal concentrations of toxic gas for periods varying from a few minutes to several days. Masks and protective clothing are sufficient protection against such concentrations but cannot be used indefinitely. Troops that must remain in gassed areas require gasproof shelters in which to rest, eat, and sleep, as well as for dressing stations, telephone stations, observation posts, command posts, and for other activities where efficiency is unduly impaired by wearing a gas mask.

a. Location.—Gasproof shelters should be so located as to take advantage of any natural protection from direct wind paths. Terrain has great effect upon the movement of a gas cloud, especially in a wind of low velocity. High hills and deep valleys deflect gas from the general direction of the wind. Whenever possible, shelters should be located where heavy concentrations of gas will not form.

b. Fundamentals of construction.—The important consideration in making a gasproof shelter is the elimination of all drafts. A special type of entrance is used which consists of a system of double doors of hung blankets which, when dropped, lie on slanting frames, the outer slanting outward and the inner slanting inward, forming an air lock. Whenever possible, the entrance to a gasproof shelter should be a walled-in passageway or tunnel several feet beyond the walls of the shelter both inside and outside, with the ends slanted so as to receive the door frames at the proper angle. The door frame is made preferably from 1-inch by 6-inch boards at the sides and 1-inch by 4-inch boards at the top and bottom. (See fig. 11.)

c. Construction of blanket doors.—Blanket doors are constructed by cutting a blanket to the proper size (about 4 inches wider and longer than the door frame) and attaching the top end to the door



When carried but not in use, the gas mask is kept in a carrier slung on the left side of the body. The canister remains in the carrier when the mask is in use. In peacetime, a metal face form and a metal hose guard are furnished to prolong the life and shape of the facepiece and hose.

FIGURE 9.—Carrier MIII.

frame. Slats are nailed horizontally at intervals across the inside and outside of the blanket to hold it in place when lowered and to keep it pressed against the frame. The inside slats must be about 2 inches

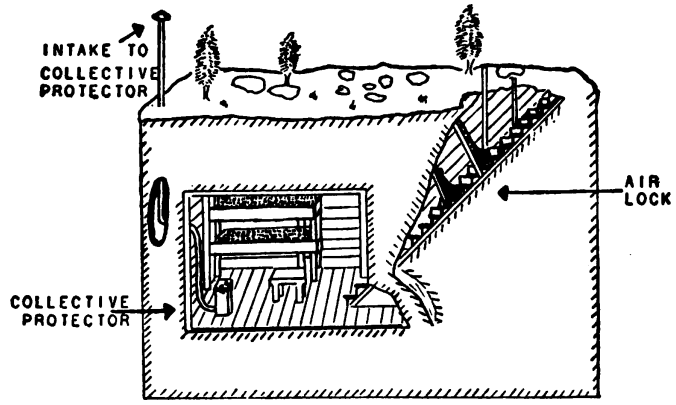


FIGURE 10.—Model of ideal dugout.

shorter than the width of the opening of the door frame. Either nails, nuts, bolts, or other special weights are used at intervals from top to bottom close to the edges of the blanket and outside of that part

of the blanket which falls on the door frames. When the blanket is lowered, the weights hang over the edge of the frame and pull the edges of the blanket with them, thus forming a flap which keeps the blanket pressed against the frame and aids in making the door airtight.

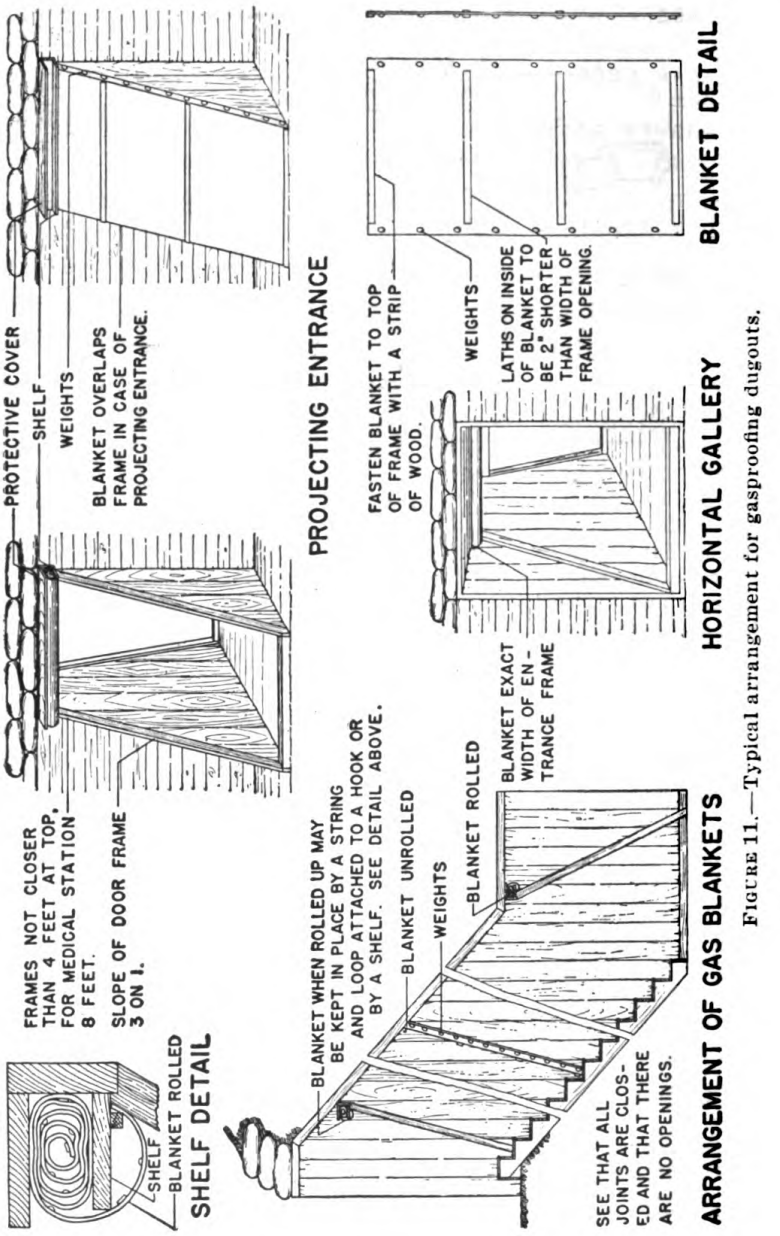


FIGURE 11.—Typical arrangement for gasproofing dugouts.

(1) *Shelf for door when left open.*—When not in use, the blanket door is rolled up and the roll is placed on a shelf above the top of the frame. If necessary, a metal cover is nailed over the shelf to protect the blanket from sun and rain.

(2) *Functioning of double-door system.*—When lowered into place, the two doors make the shelter gasproof by forming an air lock between them. To enter the outer door, one side of the blanket on the leeward side is pulled away from the frame just far enough to permit entrance; the person then enters the air lock and closes the outer door behind him before opening the inner door. When leaving the shelter, the reverse procedure is followed.

(3) *Proper distance between gasproof doors.*—When the entrance to the shelter is a simple horizontal passage, the doors are placed at an average distance of 6 to 9 feet apart. If the entrance is a stairway, one door is placed at the head of the stairway and the other at the foot where there is a horizontal passageway for a few feet. If the stairway enters directly into the room, the two doors are placed at intervals on the stairway with both slanting outward. In case of a dressing room, the space between the doors must permit stretcher bearers to bring in a stretcher without opening both doors at once.

(4) *Modifications in construction.*—Where the entrance is not a projecting passageway as described in (3) above, modifications in the construction of the blanket doors must be made. In any case, the same procedure should be observed.

(5) *Preparation for use.*—Lower both blanket doors, close all ventilators, and put out all fires. Fires use up the oxygen, draw in air from outside, and give off that odorless poison gas, carbon monoxide. See that a supply of chloride of lime is in the shelter. Spread it around between the doors at the start of a gas attack. This will neutralize any liquid agent which might adhere to the shoes of men coming from contaminated areas.

d. Ventilation.—Persons entering a shelter during a gas attack will always bring in traces of gas on their shoes and clothing. This is especially dangerous in the case of mustard, as an effective concentration entirely imperceptible to the occupants may gradually be built up. In dugouts or shelters intended to be used for a considerable time, collective protectors (par. 21) should be obtained from the chemical officer and installed. After a gas attack, a contaminated shelter may be cleared of gas by opening the doors and building a fire within. The length of time that a gasproof shelter may be occupied without ventilation may be estimated by applying the rule that a man requires 1 cubic foot of air per minute; more is desirable.

21. Collective protector.—*a.* This item of equipment is issued for use at gasproof command posts, plotting rooms, and aid stations, which are intended to be used for a considerable time and where air may, in a short time, become foul or deficient in oxygen during a gas attack. It consists of an air blower mounted on a large canister and several feet

of flexible pipe. The collective protector should only be used in an inclosure that has been made reasonably airtight. When an old building is being used, the windows and large cracks should be chinked with mud, rags, paper, or any suitable material available. Large openings such as shell holes can be closed with gasproof blankets.

b. The latest type collective protector is set up outside the room or inclosure to be protected and the pipe run inside. The concentration of gas is invariably greater near the ground level; consequently, the air intake should be as high as is practicable to place it.

c. When a gas attack starts, the collective protector is set in operation. Air from the outside is pumped through the canister, purified, and blown into the inclosure. A positive pressure of pure air is thus built up in the protected space which prevents the entrance of gas.

22. Gas alarm devices.—*a.* These items of equipment are issued to organizations. The standard type is the alarm horn which gives

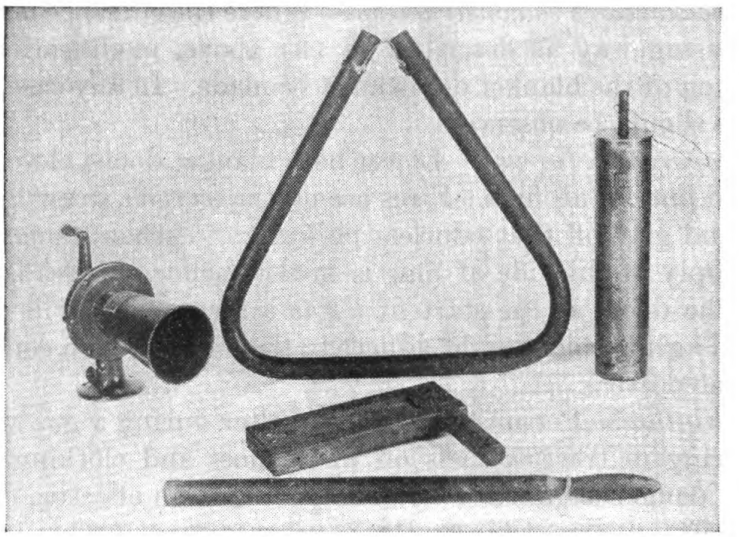


FIGURE 12.—Typical gas alarm devices.

a distinctive sound not easily confused with other sounds encountered in action. Empty shell cases or sections of iron rail may be used as improvised alarms when standard alarm horns are not available.

b. There are two classes of alarms given when an enemy gas attack occurs: general and local. General alarms are given only in the case of cloud gas attacks that are expected to involve a large area. Local alarms are given in all cases in which the presence of gas is recognized. A general alarm is sent out by all normal methods of communication and is directed to all localities that may be affected. Local alarms are usually given with alarm horns.

23. Decontamination.—*a. Protection of degassing details.*—Men detailed for decontaminating work should wear gas masks and protective clothing. The entire body must be protected. The work should be performed under a noncommissioned officer. He should be prepared to apply first-aid measures in case of necessity, and should have the necessary solvents or neutralizing agents close at hand. The men should be inspected before commencing operations to insure that they are properly protected. Facilities away from other troops should be provided for undressing and bathing after completion of their work. Men should be taught to assist each other in removing clothes used in decontaminating work without touching them to the bare skin or contaminating the clothing beneath. Facilities for disposal or cleaning of contaminated clothing should be provided. As decontaminating operations are local in character, their success will depend largely upon the equipment and facilities available.

b. Limitations.—Chemical agents may be destroyed or neutralized by other chemicals. No one chemical, however, is effective in all cases. Moreover, it is not practicable for an army to carry either a great variety or quantity of chemicals. Hence, decontaminating operations are necessarily limited. Whether they are practicable at all will depend upon the character of the chemical agent involved, extent of contamination, and importance of the contaminated area or equipment.

c. Marking contaminated areas.—When it is not practicable to decontaminate an area thoroughly, it should be marked with danger signs showing the agent involved and the date of contamination or its discovery. Generally, sentries should be posted to warn unauthorized persons against entering such areas.

d. When to decontaminate.—Decontamination work should be commenced immediately after the shelling or as soon thereafter as possible. It should be understood that when the shelling takes place at night or at other times when the temperature is relatively low, little vapor may be given off, while later, in the warmth of the sun, a high concentration may result. Areas treated during cool periods of the day should be inspected after the temperature has risen to determine whether further treatment is required.

e. Materials.—Decontaminating materials are issued in time of war to destroy or neutralize highly persistent agents of the mustard-gas type. Small areas, buildings, and equipment which have become contaminated can, within certain limits, be decontaminated. The following materials may be used for decontamination work:

(1) *Earth.*—Earth, sand, ashes, or sawdust may be spread over a contaminated area to give temporary protection. The covering layer should be at least 3 inches thick. This does not destroy the chemical agent but forms a seal, preventing for a limited time the escape of toxic vapor. Such covering will be more effective if wet down with water.

(2) *Water.*—(*a*) Lewisite is readily decomposed by water, therefore liberal wetting of areas so contaminated is sufficient to destroy this agent. The reaction product of lewisite and water is a vesicant solid substance; while it gives off a little vapor, the solid causes severe burns on contact with the body. Consequently, even long after decontamination of a lewisite area, it is dangerous to sit or lie down in the area. After treatment with water, a lewisite area should, if practicable, be covered with a layer of earth, sand, or ashes.

(*b*) Mustard gas is very slowly hydrolyzed by water. The reaction product is nonvesicant. The action of cold water on mustard is so slow that it is practically negligible for decontaminating purposes. Hot water is more effective. However, where there is sufficient drainage, mustard gas will be washed away by water. As it is heavier than water, it will lie at the bottom of pools and puddles, remaining active for a long period of time, though the water over it will retard the escape of mustard vapor.

(3) *Bleaching powder* (chloride of lime).—(*a*) This material is a white powder, not very stable, readily giving up its chlorine when exposed to the air or moisture. Consequently, it should be kept in airtight containers and used as soon as possible after removal therefrom. Bleaching powder reacts quickly with mustard gas, forming a nonvesicant compound. In contact with liquid mustard, it reacts violently not only causing flame but driving off a high concentration of mustard vapor. If the bleaching powder is mixed with sand or earth, this violent reaction does not occur. The proportion should be about one part of bleaching powder to three parts of sand or earth. One pound of bleaching powder is required per square yard of gassed area.

(*b*) In the decontamination of equipment, bleaching powder can frequently be more easily and efficiently applied in liquid form with rags or swabs. When used as a liquid solution, the proportion should be about one part of bleaching powder to one part of water.

(*c*) For decontamination of skin of animals or human beings, chloride of lime in proportion to one part powder to two parts of water may be used, but this slurry must be removed within 5 minutes after application, otherwise it may cause irritation to the skin.

(4) *Sodium sulphide.*—This chemical is used in a 1 percent aqueous

solution. It reacts more slowly than bleaching powder but, since no heat is evolved in the process, mustard vapor is not driven off. The solution is more effective if heated before use. It may be used either as a spray or mixed with sand. In the latter case, one part (by weight) of the liquid is used with four parts of sand and the mixture spread with shovels over the gassed area. Six gallons of sodium sulphide are needed for each square yard of area to be degassed.

(5) *Green solution.*—This solution which has a greenish color is prepared by dissolving 1 pound of bicarbonate of soda (baking soda) in 1 gallon of commercial hypochlorite solution. This mixture is less efficient for destruction of mustard gas than bleaching powder but is also less corrosive to metals, hence is applicable for decontaminating metal equipment. It should be generously used with sponge or rag until surface is cleaned.

(6) *Noncorrosive decontaminating agent.*—An additional material known as agent, decontamination, noncorrosive, is prepared by dissolving 1 pound of solid in 15 pounds of solvent. This agent is much less corrosive than any of the others mentioned. It is suitable for use on leather, cotton fabrics, instruments, and other items that might be damaged by the corrosive action of bleaching powder or other chemically active decontamination materials.

f. Methods.—(1) *Shell holes.*—(*a*) In demustardizing a shell hole, not only the shell crater but the entire area of contamination about the point of burst should be treated. A 75-mm mustard gas artillery shell produces a crater roughly 2 yards in diameter; however, the diameter of the area sufficiently contaminated with liquid agent to require decontamination is approximately 14 yards. With a 155-mm shell the area is approximately 50 yards in diameter, and with the 4.2-inch chemical mortar shell it is approximately 40 yards in diameter. These areas do not center exactly on the shell hole but generally extend somewhat into the line of fire.

(*b*) Contamination is generally greatest in the shell hole itself. Pools of liquid mustard gas or large visible splashes on ground or vegetation are rarely found. In most cases mustard is only perceptible by its odor. The area outside the crater is usually much more lightly contaminated. If this area includes high grass or brush which cannot be decontaminated as it stands, it should be cut down so that it can be treated and disposed of. As a rule, 1 pound of bleaching powder for each square yard of contaminated ground is the minimum requirement.

(*c*) Sodium sulphide or green solution may be sprayed over a contaminated shell hole or first mixed with sand and spread with a shovel. Bleaching powder, however, is more effective for this purpose.

(2) *Grassland.*—An area covered with high dry grass or brush may be decontaminated by burning, provided this can be done without danger to nearby personnel. The heat will cause a heavy cloud of mustard vapor to be given off down-wind during the burning. If burning is not feasible, bleaching powder mixed with water may be sprayed on small areas.

(3) *Weapons and metal equipment.*—Greasy or oily metal surfaces contaminated with mustard gas should first be cleaned with kerosene or gasoline. These solvents do not destroy mustard, but dissolve it so that most of it may be removed. Rags used for the purpose should be burned in a fire with a good draft, as they will be grossly contaminated. After such treatment, a very thin coating of mustard will still remain on the surface of the metal so that it will still be dangerous to touch. This is difficult to remove and must be treated with neutralizing chemicals. A solution of bleaching powder mixed with water, hot sodium sulphide, or green solution, is a suitable material to use, the latter two being much less corrosive. To avoid serious corrosion in using bleaching powder mixed with water, the application should not be left on for more than an hour at most. After such treatment the surface should then be washed, dried, polished, and oiled. The noncorrosive decontaminating agent (*e* (6) above) is the most satisfactory and effective for use on weapons and metal equipment.

(4) *Clothing and fabric equipment.*—(*a*) *Airing.*—Clothing contaminated by mustard vapor only may be decontaminated by hanging up the garments so that they will be exposed to the sun and wind. In warm bright weather, 2 days' airing generally will be sufficient. Care should be taken not to hang garments close together, especially not on top of each other. In cool cloudy weather, this method should not be relied upon.

(*b*) *Steaming.*—A more positive method of destroying mustard gas in clothing is to subject it to steam. If contaminated with mustard vapor only, clothing may be decontaminated by 2 hours of steaming. If splashed with liquid mustard, steaming should be continued from 4 to 6 hours. Various kinds of steam disinfectors can be improvised from materials available in the field. The simplest is merely a large G. I. can provided with a false bottom which serves to hold the clothing about a foot from the true bottom. Six or eight inches of water is poured into the bottom of the can, the false bottom inserted, and the garments piled in. The can is then placed over a fire, the top being covered but not so tightly as to prevent escape of steam. The capacity of such a disinfector can be increased by hanging additional clothing

in an inverted canvas bag suspended over the can, the open end of the bag being tied about the sides of the can.

(5) *Shoes.*—Little can be done in the field to decontaminate shoes permeated with mustard. If only lightly splashed and before the mustard has soaked into the leather, shoes may be neutralized by applying bleaching powder or bleaching powder mixed with water. As a safety precaution, it is well for men exposed to mustard gas to shuffle their feet from time to time through a mixture of bleaching powder and dry earth or sand. Well-worn shoe leather absorbs mustard much quicker than new leather.

(6) *Leather.*—Leather, unless specially treated, absorbs mustard almost instantly. Hence, equipment such as saddles and harness should be treated with a hot solution of bleaching powder and water immediately after being sprayed or splashed with this agent.

(7) *Buildings.*—In general, if liquid agents have been carried into buildings by shell fire, the buildings should be abandoned for military use in the field. If a building which has not been gasproofed has been subjected to vapors from vesicant agents, the ceilings and walls should be sponged or washed with a mixture of bleaching powder and hot water and the wooden floors should receive a thorough scrubbing with the same material.

24. Protection of food and water supplies.—*a. Protective covers.*—Tarpaulins and vehicle covers made impervious to the persistent gases will be issued in time of war to protect transportation, equipment, and supplies.

b. Protection at the front.—(1) Rations and forage issued to troops at the front should, insofar as practicable, be kept in airtight containers until required for use.

(2) In stabilized situations and otherwise as circumstances may permit, gasproof shelters should be used for storage of food and water supplies in the field.

(3) Cooked rations sent to troops should be kept in closely covered containers until issued. Kitchens should be covered with paulins for protection against chemical spray. Tent flies or other overhead covers should invariably be provided for field kitchens. In case canned goods are sprayed with chemicals, the cans should be decontaminated by boiling before they are opened.

(4) Food and water not protected by containers, which have been contaminated by chemical agents, are normally discarded. In case there is a shortage of food, special instructions from a medical officer will govern as to its decontamination.

c. Contaminated water.—(1) Water contaminated with mustard should be avoided.

(2) Water contaminated by arsenical agents, such as lewisite and adamsite, or by white phosphorus cannot be purified and should be avoided.

25. Protection of supplies, equipment, and munitions.—*a. Weapons.*—(1) Field pieces, machine guns, rifles, and other steel weapons may actually be rendered useless by long exposure to the corrosive action of certain chemical agents. Unpainted working parts are especially vulnerable and as a general precaution should be kept well coated with oil or grease. Weapons should invariably be inspected following gas attacks and, as soon thereafter as practicable, cleaned and reoiled. Gasoline will remove the old lubricant; water and soap, washing soda, or green solution should be used to clean the affected parts before new lubricant is applied.

(2) If sprayed with mustard gas, weapons must be decontaminated before it is safe to handle them. Bleaching powder mixed with water should be used on the wheels, trail, and outside of barrel of field pieces, but its use on breech locks, traversing screws, and other working parts of such weapons should be avoided because of its corrosive effect. Such parts should be treated as instruments. Alcohol or gasoline, hot water and soap, or other noncorrosive material as may be provided, should be used to remove the mustard. Wooden gunstocks contaminated with mustard should be treated repeatedly.

b. Ammunition.—Since brass shell and cartridge cases are particularly susceptible to corrosion by gases like phosgene, ammunition should be kept in sealed containers. If ammunition becomes badly corroded, it may be necessary to discard it or to clean it thoroughly before it is used.

c. Instruments.—Instruments such as those used in fire control should be kept in their containers except when in actual use. If exposed to corrosive gases, they should be cleaned with alcohol (or gasoline, if alcohol is not available) at the earliest opportunity, after which their moving parts should be given a thin coating of light machine oil.

d. Airplanes.—Vesicant spray attacks against airdromes are likely. Where it is not feasible to place airplanes in hangars, gasproof covers, at least for cockpits and machine guns, will be provided for placing over these parts when airplanes are not in use. Mustard sprayed on wings and fuselage of an airplane may do little if any harm; but if seats, instrument board, control, and firing apparatus are sprayed, pilots and observers later using the airplane may become casualties. Moreover, the decontamination of such parts will be extremely difficult. If an airplane becomes contaminated with a vesicant agent, it should be taken as soon as practicable to an airdrome where it can be properly

decontaminated. Bleaching powder, hot water, and soap are used for this purpose.

e. Vehicles.—Drivers of vehicles which have been contaminated should be careful not to come in contact with contaminated parts in getting on or off a wagon or truck. Seat cushions which have been sprayed should be discarded. Washing thoroughly with water and using bleaching powder on badly contaminated spots is all that can be done in the field in decontaminating vehicles. Contaminated harness should be carefully cleaned before use.

f. Inflammable supplies and equipment.—Inflammable supplies and equipment should be piled in small stacks far enough apart to prevent one stack from catching fire from another in case the enemy uses incendiary agents.

SECTION IV

TRAINING MASK MI

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Gas mask drill	28
Visual mask inspection by individuals	29
Inspection in ranks	30
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Repairs	32
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26. Description.—The training mask has been developed for the purpose of supplying the Army with a cheap and lightweight gas mask for training purposes. It differs from the service mask in weight, in construction of the facepiece, shape and size of the canister, and in the shape, weight, and size of the carrier. The training mask is essentially a snout type mask and is without hose.

a. The *facepiece* of the training mask is a universal size rubber facepiece fully molded with integrally molded air supply tubes and deflectors. The eyepieces are shaped to give the maximum amount of vision and are crimped on. The head harness attachments and chapes are riveted to the facepiece by countersunk rivets. The facepiece has been shaped so as to provide the least amount of dead air space within the mask. Two types of training masks are furnished, differing only in construction of the outlet valve; one type is known as the mask, training, MI, and is equipped with outlet valve MIV, which consists of a molded rubber valve seat and a circular rubber disk attached by means of a rubber stud. The second type is known as the mask, train-

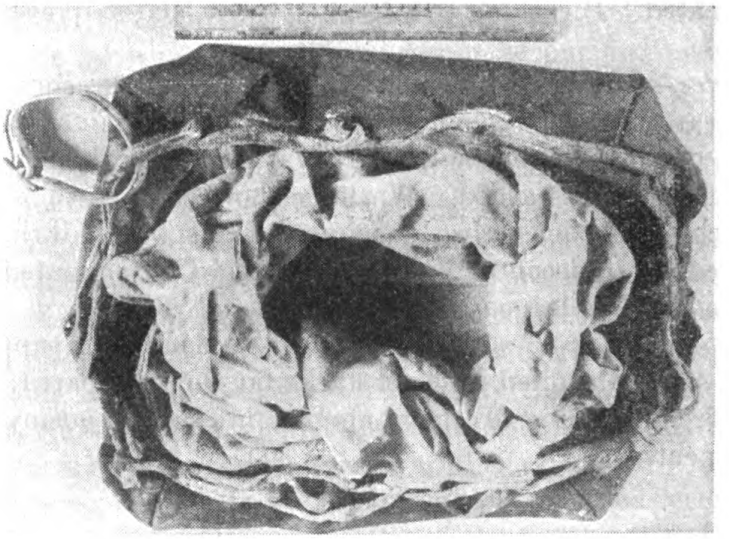

FIGURE 13.—Pigeon bag.

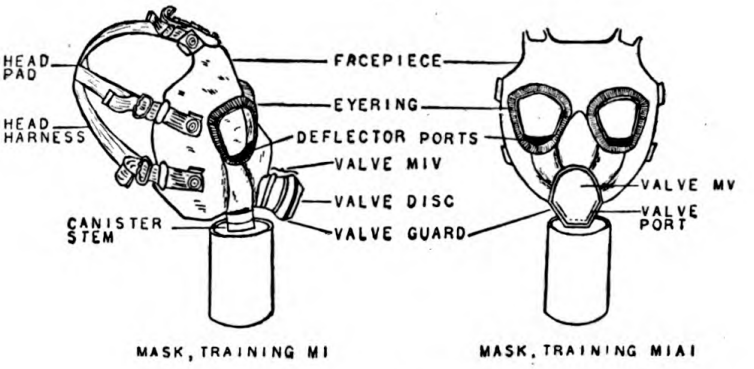

FIGURE 14.—Parts of mask.

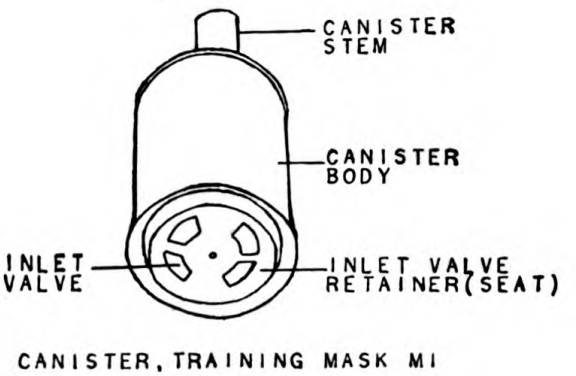

FIGURE 15.—Parts of canister.

ing, MIA1, and is assembled with outlet valve MV, which is a modification of the standard outlet valve for the service mask. It has a metal valve guard. Figure 14 illustrates the differences in the two masks as well as the principal parts.

b. The *canister* for the training mask is cylindrical in shape, and contains a mechanical filter and chemical filter similar to the standard service canister. The air enters through an outlet valve and passes through the canister stem which is attached directly to the facepiece, thence through air passages molded into the facepiece and impinges on the eyepieces. Nomenclature is shown in figure 15.

c. The *carrier* is a lightweight cloth bag furnished with a single adjustable shoulder strap and closed by means of a snap fastener. A body cord permits tying the carrier to the waist.

27. Limitations and use.—The training mask is intended for training purposes only. However, the canister will protect against all standard chemical agents, but it should be noted that the amount of protection furnished against the standard casualty type agents is equal to many of the canisters used in the World War of 1917–18, and in the case of irritant smokes, superior. The life of the training canister is less than that of the latest standard canister. The resistance of the training canister is slightly greater than the standard canister, but less than the World War types. In case of emergency, it can be used for protection against a chemical attack. This gas mask must not be used around fires, within buildings where exhaust motor gas or carbon monoxide is to be found, in inclosed spaces where the oxygen content of the air may be too low to support life, or where concentrations of toxics are too high. The training mask will not be used for fumigation work.

28. Gas mask drill.—*a. General.*—The drills for the training mask follow the drills as set up for the standard service mask as closely as possible, considering the differences in construction. In general, the notes describing the movements and commands for the standard masks apply to the movements for the training mask. Where these differ, supplemental notes will be found in the following drill procedures.

b. Commands.—(1) *To sling mask.*—With carrier held in left hand by shoulder strap (fig. 16), flap of carrier facing away from the body, the command is: 1. ***Sling,*** 2. ***MASK.*** With both hands grasp top of shoulder strap. Swing strap over the head, at the same time passing left elbow through loop (fig. 17). Place strap at junction of neck and right shoulder. Straighten out strap.

NOTES.—1. Mounted troops tie body cord loosely about waist on slinging carrier.

2. When either full field or light pack is worn, the training mask carrier is slung over equipment. When, for any reason, packs are removed in the field, the carrier is immediately reslung.

(2) *To unsling mask.*—With carrier slung, the command is: 1. ***Unsling,*** 2. ***MASK.*** With both hands grasp shoulder strap and raise and slide it over the head. Hold shoulder strap in left hand, flap of carrier away from body (fig. 16).

(3) *To adjust mask.*—Being at the slung position for detailed analytical instruction, the command is: 1. ***By the numbers,*** 2. ***GAS.*** At the command ***Gas,*** stop breathing, dispose of arms and equipment.

FIGURE 16.—Preparing to sling carrier.

FIGURE 17.—Slinging carrier.

NOTE.—Mounted troops untie body cord before unslinging carrier.

Remove head covering. Hold bottom of carrier with left hand and with the right open flap (fig. 18). Grasp top of facepiece with right hand. Bring facepiece smartly out of carrier (fig. 19) to a point in front of the face, chin high. Grasp facepiece with both hands, thumbs inside and below lower head harness strap, fingers extended outside facepiece, outer edges of palms together so as to form a

pocket for the chin of facepiece (fig. 20). Thrust chin forward (fig. 21).

TWO. Seat chin firmly in mask. Sweep head harness smoothly over the head without twisting straps. Center head pad well down on back of head (fig. 22).

THREE. Place left palm over outlet valve making sure it is closed

FIGURE 18.—GAS. Open carrier.

FIGURE 19.—GAS. Withdraw mask.

(fig. 23) and exhale vigorously to clear inside of mask of any gas. Resume breathing (in drill without the numbers). Beginning at the chin and with an upward and backward sweeping motion of the palms, press edges of facepiece smoothly on face (fig. 24). Also recheck seating of head harness.

FOUR. Replace headpiece. Fasten carrier flap. Resume original position.

(4) *To check fit of mask.*—With mask adjusted, to check fit of mask the command is: 1. ***Check,*** 2. ***MASK.*** At the command ***Mask,*** exhale. Place palm of right hand over inlet valve making sure it is closed. Inhale deeply. The facepiece should collapse and cling to the face (fig. 25). Reseat mask by pressing edges and drop right hand. Resume breathing.

(5) *To test for gas.*—The mask being adjusted, the command is: ***TEST FOR GAS.*** Dismount, if mounted. Take a moderately full

breath. Stoop down so as to bring the face close to the ground but do not kneel, care being taken that the rifle or any part of the body

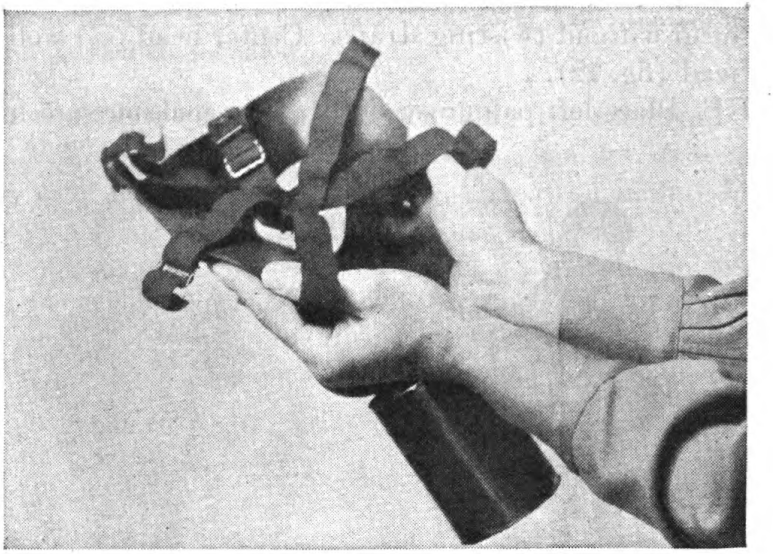

FIGURE 20.—GAS. Forming facepiece into pocket for chin.

FIGURE 21.—GAS. Position ready to place facepiece on face.

FIGURE 22.—GAS. TWO. Straightening head harness.

except the feet does not touch the ground. Insert two fingers of right hand under facepiece at right cheek. Pull facepiece slightly away

from right cheek and sniff gently. If gas is detected, readjust facepiece and resume the erect position. Close outlet valve by placing palm of left hand over outlet valve, making sure it is closed, and blow vigorously to clear inside of mask of any gas. Next, beginning at the chin, and with an upward and backward sweeping motion of the palms of both hands press edges of facepiece smoothly on the face. Recheck fit and position of head harness.

NOTE.—Individuals should be trained to test for gas automatically and habitually before removing the mask.

(6) *To remove mask.*—The command is: 1. ***Remove,*** 2. ***MASK.*** At the command ***Mask,*** prepare chin strap of headpiece for removal

FIGURE 23.—GAS. THREE. Closing outlet valve (side view).

FIGURE 24.—GAS. THREE. Smoothing facepiece.

and grasp headpiece with left hand and remove it. At the same time, with the right hand grasp facepiece at junction of canister and facepiece and with an outward and downward motion pull facepiece clear of chin (fig. 26); pass facepiece up and over the head. Place canister with facepiece up under left armpit (fig. 27). Replace headpiece. Hold mask at junction of canister and facepiece with the right hand and hold chest high at center of body (fig. 28).

(7) *To replace mask.*—With the mask held in the right hand as at the end of ***Remove mask,*** at the command, 1. ***Replace,*** 2. ***MASK,***

using the left hand, fold head harness inside of facepiece (fig. 29). Also, with the left hand, open and hold open flap of carrier. If carrier is difficult to open, hold carrier to the side with right hand which is holding the mask.

TWO. Place canister in top of carrier, outlet valve of mask to the front and using both hands, slide mask into carrier without forcing (fig. 30). With both hands close flap of carrier. Drop hands to side.

29. Visual mask inspection by individuals.—*a. General.*— The check of the mask as described in paragraph 28*b*(4) is not conclusive as to the complete serviceability of the gas mask. If, during execution of the command ***Check mask,*** the facepiece fails to cling to

FIGURE 25.—CHECK MASK. Stopping inlet valve.

the face and indications are observed that a leak is in the mask other than between the facepiece edges and the face, a minute visual inspection and test must be made.

(1) If no leak is detected, the mask is assumed to fit and be in working condition.

(2) If air leaks in between the face and facepiece, carefully adjust head harness by pulling up ends of each of opposing head harness

FIGURE 26.—REMOVE MASK. Removing facepiece.

FIGURE 27.—REMOVE MASK. Replacing headpiece.

FIGURE 28.—REMOVE MASK. In readiness to place mask in carrier.

FIGURE 29.—REPACE MASK. Folding head harness.

straps nearest the leak, taking in the same amount of slack in each at the same time so as to keep head pad centered. Press edges of facepiece smoothly against the face and test again as in ***Check mask.*** Tightening of the head harness should be done carefully and a little at a time until the leak is stopped. Headaches may result from head harnesses that are adjusted too tightly.

FIGURE 30.—REPLACE MASK. TWO. Placing mask in carrier.

FIGURE 31.—ONE. Examining canister.

(3) If air leaks out after resumption of breathing, a sticking outlet valve is indicated. Remove mask and carefully open valve disk if a MIV valve, or open valve ports if a MV valve.

(4) If, after thoroughly checking seating of facepiece as described above, leakage of air other than around the edges of facepiece is detected, the mask will be removed and a thorough examination made as described in *b* below.

(5) This inspection is not executed as a precision drill, but will be carried out in the manner explained in *b* below. For training and purpose of forming the habit for this inspection, the soldier will be taught this exercise in the sequence as shown.

b. Procedure.—(1) *For mask.*—Being in position of ***Check mask*** and for training purposes only, the command is: 1. ***Inspect,*** 2. ***MASK.***

ONE. Remove mask and carefully examine canister (fig. 31).

NOTE.—The following faults may indicate a slightly defective canister: missing inlet valve; edge of inlet valve disk stuck to the retainer; holes in disk of inlet valve, or permanent set of the rubber; insecure connections at the canister nozzle. Serious defects are holes in canister body; rust spots and weaknesses in canister body; loose or rattling contents. Rust and weaknesses in the canister body indicate that the chemical filling has been damaged by water getting inside the canister and that corrosion has set in. This will cause lowering of the chemical efficiency and marked increase in breathing resistance. Such a canister will be replaced.

TWO. Examine outlet valve (fig. 32). Minutely examine facepiece (fig. 33) and head harness (fig. 34). Men with unserviceable masks report to instructor. Others place mask in carrier.

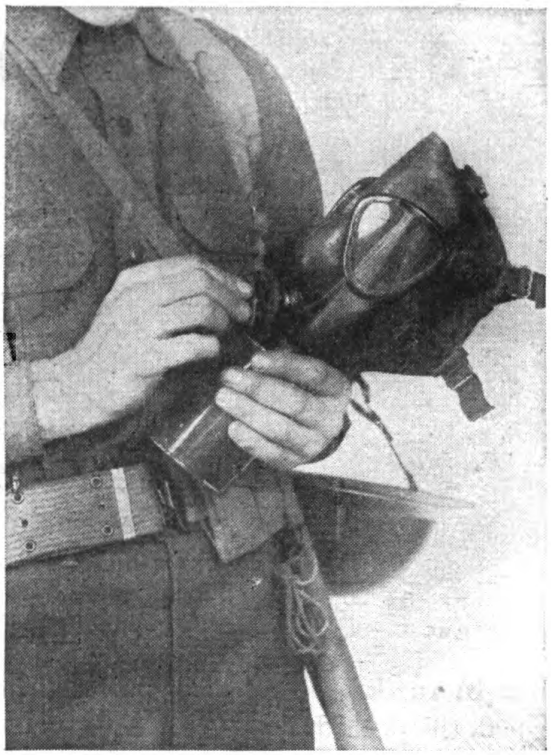

FIGURE 32.—TWO. Examining outlet valve.

NOTES.—1. Sources of trouble are at the valve ports or edge of valve disk and connections at the outlet, valve stem, and with mashed or bent outlet valve guards. Valves with these defects will be replaced.

2. Occasionally after disinfection, and also during freezing weather, the valve ports or edges of the valve disk will freeze or stick, causing very high resistance to exhalation. When this happens, it is necessary to examine the valve and carefully open the ports or disks.

3. Sources of trouble are at the connections of the facepiece to the outlet valve and to the canister nozzle; also, cracks and splits near eyepiece binder

rings and near the rivets which secure the head harness chapes. The elastic webbing of the head harness deteriorates very rapidly and must be inspected frequently. Holes and cracks in the facepiece may be patched. Head harness can be replaced.

(2) *For carrier.*—To inspect the carrier the command is: 1. ***Inspect,*** 2. ***CARRIER.*** At this command, unsling the mask, open carrier, and hold by shoulder strap with the left hand. Examine outside of the carrier for condition, cleanliness, and completeness. Look inside the carrier to see that the mask is correctly placed within. Button the flap and resling the mask.

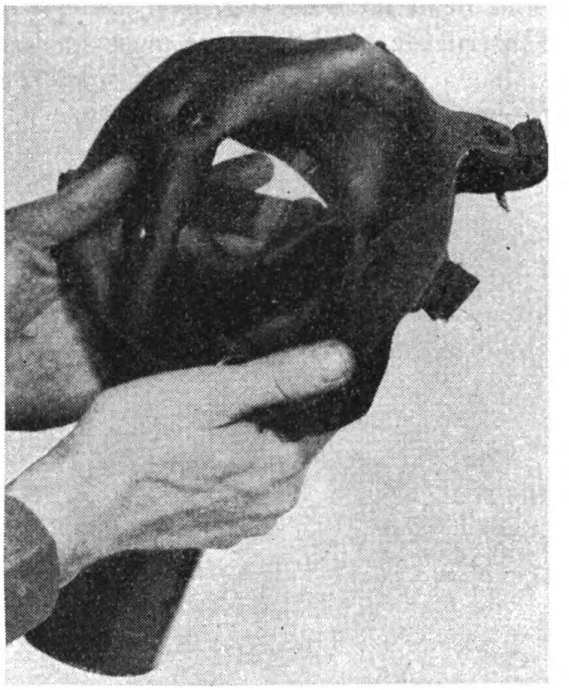

FIGURE 33.—TWO. Examining facepiece.

30. Inspection in ranks.—For inspection in ranks where training masks are issued, the procedure provided for service masks will be followed.

31. Storage and care.—In general, the same rules apply for care in use and storage of the training mask as for the standard service gas mask.

a. Deterioration.—The rubber of the facepiece and valve is subject to deterioration from heat, sunlight, and continued distortion. Water or excess moisture in the canister will destroy the chemicals and cause corrosion of the metal parts.

b. Storage.—For storage within an organization and when not in use, the facepiece should be filled out by a crumpled newspaper form,

the mask properly placed in the carrier without distortion, and hung by the shoulder strap from a hook in a cool, dark closet.

c. Disinfection.—The mask is intended for personal use of the soldier, and it is expected that he will have it in his possession or with his equipment. If for any reason the mask is to be exchanged, turned in, or used by another person, it must be disinfected. During disinfection operation, care must be taken that the solution does not get into the deflector ports and thence into the canister. The mask is held by the canister with the facepiece down, swabbed with the dis-

FIGURE 34.—TWO. Examining head harness.

infectant solution, and all excess moisture shaken out before it is returned to an erect position.

32. Repairs.—Repair procedure and description for the training mask will be published in TM 3–205 (now published as TR 1120–35).

33. Gas mask training.—*a. Objectives.*—Gas mask training is mandatory. In this training there are two objectives: first, instruction and repetitive drills for the purpose of forming correct habits of adjustment, testing, and care; and second, physical training while masked to develop the ability of the individual to perform his usual duties with the least loss of efficiency.

b. Procedure.—(1) A practical gas mask examination procedure which may be carried out within an organization is as follows:

(*a*) Erect a pyramidal or wall tent on the company drill ground and see that the tent is reasonably well closed around the bottom, near the corners, and at the top.

(*b*) Make a small generator out of a gallon tin can similar to the drawing in figure 35.

(*c*) A concentration of tear gas is set up inside the tent by heating two issue capsules of CN tear gas over the improvised generator. If the concentration thins during the exercise, add another capsule.

(2) The troops are passed through the field gas chamber twice in squad groups. The first time, masks are adjusted before entering the tent. Each squad remains in the tent 2 or 3 minutes and then files out. Leaks or faulty adjustments are indicated by lacrimation before the mask is removed. Masks are then aired until all squads have passed through the tent when the squads are again, in turn, sent into the tent.

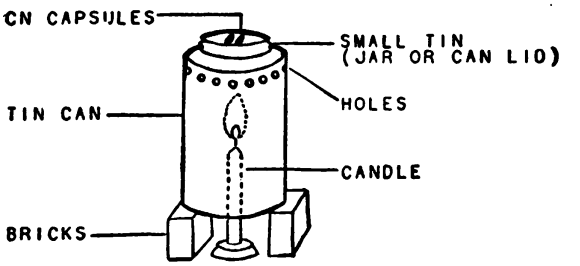

FIGURE 35.—Improvised tear gas generator.

(3) At this second time, however, masks are not adjusted until the individual has entered. After 2 or 3 minutes in the concentration, the squad again files out. Faulty adjustment may be indicated by obvious channels and failure to seat the facepiece to the face, eyepieces not alined with the eyes, and head pad not centered in the rear of the head. Failure of the individual to pass the test is indicative of inability to adjust his mask properly under conditions of stress. In such cases, more preliminary drill will be required.

(4) After the test, tents should be thoroughly aired in the sun and wind before being put away.

Caution: Do not rub eyes after this test. As soon as possible wash hands and face with soap and water to relieve the slight discomfort of the tear gas.

c. Daily exercise.—Practice and physical training to be carried out in connection with other forms of training includes a daily exercise in wearing the gas mask, gradually increasing the time of wearing from a few minutes to a maximum of an hour or more.

CHAPTER 4

MOTOR TRANSPORT

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SECTION I

GENERAL

Paragraph
Requirements for efficient operation 34

34. Requirements for efficient operation.—*a. Assignment of drivers.*—A driver and an assistant driver will be assigned to each motor vehicle. Except for instruction, inspection, or other like purposes, the vehicle will not be operated by other drivers if it can be avoided.

b. Vehicle abuse.—Vehicle abuse is the chief cause of mechanical failures, excessive operating and maintenance costs, and general unsatisfactory performance of the motor vehicle and its component parts. The following forms of vehicle abuse will be prohibited:

(1) Improper use of controls, particularly gear shift, clutch, brakes, and choke.

(2) Racing engine, especially when cold.

(3) Overspeeding, particularly over rough roads and across country.

(4) Improper lubrication.

(5) Deferred maintenance, including lack of proper servicing and adjustments.

(6) Lack of systematic inspection and follow-up.

(7) Overloading and improper loading.

c. Speed limits.—(1) The caution plate mounted on a motor vehicle indicates the maximum safe speed for which the vehicle is designed. In no case will this speed be exceeded.

(2) The following table indicates normal speed limits for individual vehicles under favorable conditions:

Vehicle	In towns (m. p. h.)	Open highway (m. p. h.)
Trucks	15	35
Command trucks (½-ton)	15	45
Light passenger vehicles	15	50
Motorcycles	15	50

(3) Fast driving over rough, slippery, or congested roads will not be permitted.

(4) Applicable speed limits set by State or local regulations will not be exceeded.

(5) Regulated governors, when installed, will be set and sealed at the maximum speed considered safe and not in excess of that indicated on the name and caution plate.

(6) (*a*) Tanks and combat cars will be driven habitually on the tachometer in an appropriate gear and not in excess of the prescribed speed in engine revolutions per minute.

(*b*) In the conduct of marches with columns which contain tanks, the pace will be set by a leading vehicle at such a rate as will insure that all tanks in the column can keep up without exceeding the prescribed economical speed in engine revolutions.

(*c*) When passing through towns and villages, a proper reduction in speed will be directed by the column commander, who will control the march in such manner as to insure the safety of spectators and civilian traffic and to prevent prolonged operation at low speeds in a high gear.

d. Factors affecting operation.—(1) The following factors which materially affect the service rendered by motor vehicles will be impressed on all operating personnel who are concerned with the supervision, operation, maintenance, and inspection of motor transport equipment.

(*a*) Proper selection, training, and discipline of operating and maintenance personnel.

(*b*) Strict supervision and control of operations.

(*c*) Organized maintenance with adequate repair facilities and the performance of routine maintenance and inspection functions.

(*d*) Serviceable mechanical condition of vehicles.

(*e*) Recognition of the capabilities and limitations of all types of vehicles in operation.

(*f*) Careful reconnaissance of routes to be traveled.

(*g*) Recognition of the capabilities and limitations of the drivers.

(*h*) Training and experience of the noncommissioned personnel.

(2) The necessity for control, for constant and intelligent supervision, and for proper selection, training, and discipline of the operating and maintenance personnel cannot be stressed too forcibly. The discipline required of personnel in organizations operating motor vehicles is that discipline which will guarantee strict adherence to the instructions received in training and will result in the proper operation and maintenance of motor transportation. Selection and training of personnel are covered in subsequent sections.

SECTION II

THE DRIVER

Paragraph
Training 35
Selection 36

35. Training.—*a.* The manner in which the individual drivers perform their duties determines the mobility and dependability of the motor vehicle fleet as well as of the single vehicle. To train drivers who are competent to operate the vehicles of their organizations either alone or in convoy, a systematic and progressive course of instruction must be given.

b. (1) Methods of instruction follow those prescribed in FM 21–5 (now published as TR 10–5), which include the following steps or phases:

(*a*) Explanation.

(*b*) Demonstration or illustration.

(*c*) Application or practice to acquire skill in execution.

(*d*) Examination or test to determine progress or proficiency.

(*e*) Discussion to point out correct or incorrect methods of execution.

(2) To attain the maximum progress, an instructor will be provided for each three students. The students alternate in driving; those not driving observe the instruction of or the execution by the student who is driving.

36. Selection.—The individuals selected for drivers must be of average size or larger, be moderate in habits, alert, dependable, and intelligent, and have good judgment. In addition they should possess the following qualifications:

a. An accident-free driving record.

b. Normal vision without glasses (visual acuity of not less than 20/30 acceptable).

c. Average depth perception.

d. Normal vision at night.
e. Normal hearing.
f. Normal reaction time.
g. Ability to differentiate between red, green, and amber lights.

SECTION III

PRELIMINARY INSTRUCTION

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37. Responsibility.—The training and the responsibility of the driver in making his organization an efficient one are very important. This responsibility includes—

a. Operation and maintenance of motor vehicles in accordance with instructions.
b. Care and condition of vehicle tools and equipment.
c. Loads and loading.
d. Reports and trip ticket.

38. Organization of motor park.—The driver must be acquainted with the organization of the motor park and with his duties in connection therewith.

39. Fire precautions and fire fighting.—Motor vehicles, shops, and parks are constantly exposed to fires. Drivers must therefore be instructed in and required to comply with pertinent fire-prevention regulations. In addition they must be instructed and drilled in the use of fire-fighting equipment and in removing vehicles and other property from the danger area.

40. Accident prevention.—The formulation and observance of definite rules will eliminate the majority of accidents incident to the operation and maintenance of motor vehicles. These rules will include the following:

a. Place the transmission gear-shift and power take-off levers in neutral and set the hand brake before hand cranking an engine or starting it with the starting motor.
b. Make sure the way is clear before a vehicle is moved. If the

driver cannot see the road, he should be directed by a dismounted individual who should precede the vehicle at a safe distance. This is particularly important when a vehicle is backed or is moved through bivouac areas and across country at night without lights.

c. Stop the engine before anyone gets under a vehicle. If it is necessary for a mechanic to work under the vehicle while the engine is running, precaution must be taken that the vehicle cannot move accidentally.

d. Block up a vehicle safely before the wheels are removed.

e. In order to prevent accidental shorts, remove or disconnect the battery when the engine is being cleaned.

f. Provide ample ventilation for garages, shops, vehicle cabs, and vehicles carrying personnel.

g. Do not operate motor vehicle engines in a garage or shop longer than necessary to move the vehicle in or out, unless the vehicle is standing near wide open doors or the exhaust gases are removed through a safe outlet fixture.

h. In case of carbon monoxide poisoning, remove the patient to open air, keep him quiet, apply artificial respiration and warmth, and obtain medical assistance as soon as possible.

41. Nomenclature and general purpose of major units of motor vehicle.—Preliminary instruction will cover the nomenclature and purpose of major assemblies only, in order that the driver may become familiar with his vehicle without being confused by details. Detailed instruction in nomenclature, function, operation, use, lubrication, maintenance, and limitations of motor vehicles is given in subsequent periods.

42. Signals.—*a.* Before a driver changes the direction or slows the speed of his vehicle, he will give the appropriate arm signal to warn other drivers of the contemplated change. Arm signals will be clearly made and will be given in time to afford ample warning.

b. The following arm signals are prescribed for military use:

(1) *Turn right.*—Extend the left arm outward at an angle of 45° above the horizontal.

(2) *Turn left.*—Extend the left arm outward horizontally.

(3) *Slow or stop.*—Extend the left arm outward to an angle of 45° below the horizontal.

(4) *Start engine.*—Simulate cranking.

(5) *Report when ready to move* (given by unit commander).—Extend the arm vertically, fingers extended and joined.

(6) *Ready to start.*—Senior in truck stands on running board, faces leader, and extends the arm vertically, fingers extended and joined palm toward the leader.

(7) *Stop engines.*—Cross arms in front of body at the waist and then move them sharply to the side. Repeat several times.

(8) *Increase speed.*—Carry closed fist to the shoulder and rapidly thrust it vertically upward several times to the full extent of the arm.

(9) *Prepare to mount.*—Extend the arm horizontally to the side, palm up, and wave the arm upward several times.

(10) *Prepare to dismount.*—Extend the arm diagonally upward to the side, palm down, and wave the arm downward several times.

(11) *Close up.*—Extend the arm horizontally to the side, palm to the front, then describe a 2-foot circle. Each driver repeats.

(12) *Open up.*—Extend the arm horizontally to the side, palm to the front, then move the arm up and down describing a 2-foot arc. Each driver repeats.

(13) *Pass and keep going.*—Extend the left arm horizontally and describe small circles toward the front with the hand.

(14) *Immediate danger.*—Use three long blasts of whistle or automobile horn repeated several times, or three equally spaced shots with rifle or pistol. The person giving the signal points in the direction of impending danger. This signal is reserved for warning of air or mechanized attack or other immediate and grave danger.

(15) *Drivers to turn around simultaneously.*—Extend both arms horizontally toward the drivers and describe small vertical circles, then signal forward in the desired new direction. When the distance between vehicles permits and the convoy is long, this signal may be given by a motorcycle messenger passing back along the column.

c. Special signals for ceremonies and drills will be found in the manuals for the arms and services.

d. Electrical and mechanical signals will be used when vehicles are so equipped.

43. Road rules and traffic regulations.—Observance of prescribed road rules and traffic regulations permits the movement of traffic with a maximum of safety and a minimum of confusion and control. The following general rules will be observed by all drivers:

a. Vehicles will keep to the right of the road.

b. The appropriate warning signal will be given before changing direction, slowing down, or stopping.

c. The driver will be alert and pay attention to road signs, convoy signals, and traffic directions.

d. The right-of-way will be given promptly to faster moving vehicles.

e. Speed will be reduced on dry, dusty roads.

f. Speeds for night driving, without lights, will be determined

by road conditions, degree of visibility, and skill of the drivers.

g. Lights will be dimmed when meeting another vehicle, if driving at night with lights.

h. Unnecessary use of horns is prohibited.

i. A disabled vehicle will not unnecessarily delay the march of a column. Instead, the driver will pull to the right of the road and signal the succeeding vehicles to pass.

j. A driver who has been assigned a place in a column will not pass another vehicle in the same column unless that vehicle is disabled or he receives a signal to pass.

k. A vehicle will never pass traffic moving in the same direction—

(1) When going around a corner or blind curve.

(2) When ascending or descending hills unless safe passage is assured.

(3) At street intersections or crossroads.

(4) When the road is not wide enough to allow at least 2 feet between vehicles.

l. A driver when meeting and passing an oncoming vehicle will—

(1) Pass on the right giving at least half the road.

(2) Slow down if operating conditions are hazardous.

(3) Permit the vehicle having a clear road ahead to have the right-of-way.

m. Vehicles will be halted at railroad crossings not guarded by military personnel or civilian watchmen.

n. Vehicles will be slowed down to a safe stopping speed at all road intersections not covered by traffic control personnel or traffic control devices.

o. Vehicles will not be permitted to coast down hills with the clutch disengaged or the transmission in neutral.

p. Vehicles will clear the roadway before being halted.

q. Vehicles will not be halted on bridges, in defiles, at points where the vision of other drivers is restricted, or in such manner as to block cross traffic or entering side traffic.

r. During the halt—

(1) The engine will be stopped if the vehicle is to stand longer than a few minutes.

(2) All personnel will keep to the right of the vehicles.

(3) The prescribed inspection and maintenance functions will be performed (par. 60).

s. Passengers will not mount or dismount from moving vehicles.

t. State and local traffic regulations will be observed unless otherwise ordered.

44. Chains and traction devices.—Chains and traction devices should always accompany the vehicle to which they pertain. They should be kept in serviceable condition and in proper adjustment to permit installation with a minimum of delay. Chains and traction devices should be removed when the necessity for their use no longer exists in order to prevent unnecessary damage to roads.

a. Chains.—Chains are generally necessary in mud, sand, snow, or slush ice. Chains should not be used on ice-covered roads when they cannot bite into the ice. The following general rules apply to the application and use of chains:

(1) The chains are applied before the vehicle becomes mired.

(2) The chains are so applied that rotation of the wheel tends to close the chain fastenings. If improperly installed, rotation of the wheel opens the fastening and the chain will be lost.

(3) Fairly loose adjustment gives better traction and less tire wear than tight adjustment.

(4) On all wheel-drive vehicles without center differential or other compensating device, chains must be installed on all wheels to prevent unnecessary strain.

(5) When only single chains are provided for dual-tired wheels, they should be installed on the outside tires.

b. Traction devices.—(1) Traction devices temporarily convert a truck into a vehicle having many of the cross country capabilities of a tractor. Training with them should be conducted frequently under conditions favorable to their use, such as in sand or mud.

(2) If traction devices which are applied to individual wheels cannot be tightened sufficiently to prevent slippage of the wheel inside the device, they should be chained to the wheel.

(3) When traction devices are applied on a six-wheel, six-wheel-driver (6 x 6) truck, it is preferable under most conditions to use an oval-band coupling around the middle and rear wheels rather than individual devices on each of these wheels. The truck then becomes a half-track vehicle with exceptionally low ground pressure.

45. Loads and loading.—In order that vehicle capacity and cargo space may be efficiently used, it is necessary that drivers have a knowledge of loads and loading. The driver ordinarily will not be required to handle cargo during the loading and unloading operations, but he will be directly charged with the following responsibilities:

a. Maximum authorized load not exceeded unless ordered by proper authority.—The maximum pay load, road and cross country, and the maximum tow load are shown on the vehicle name and caution plate. These loads should not be exceeded except in case of emergency, and

then only when specially authorized. Lack of knowledge of cargo weight is not an acceptable excuse for overloading. When scales are not available and cargo weight is unknown, adherence to the following general rule will prevent overloading: The position of the rear springs should be determined with the maximum authorized load. The position of the spring ends below this line indicates that the vehicle is overloaded.

b. Proper location and reasonable distribution within the body.—Efficient loading insures maximum use of cargo-carrying capacity and safety in transit. One loose piece of cargo may release an entire load; and, if the load is unbalanced, the vehicle is in danger of overturning, is difficult to handle, and is a menace to traffic. The following procedures should be observed for correct loading:

(1) Heavy supplies should be placed at the bottom of the load and properly distributed.

(2) In building up the load, place cargo carefully to avoid shifting and distribute the weight equally on both sides of the body.

(3) Loads should not be built up too high. High loads cause swaying and danger of overturning and make the vehicle hard to handle.

(4) If the truck is not a covered vehicle, a tarpaulin should be placed over the cargo as a protection against sun, dust, or rain.

c. Proper securing of the load to the body or to the pintle.—(1) Loads built up above the top of the vehicle body should be securely lashed. The equipment for lashing loads on trucks consists of two 60-foot ropes which are sufficient for any ordinary cargo. Lash hooks or rings are usually provided on the bodies of cargo-carrying vehicles. The following procedure should be observed when lashing the load:

(*a*) Fasten the end of one rope to one of the front lash hooks or rings.

(*b*) Pass the rope diagonally across the top of the load, through or under the second rope support, and pull the rope tight.

(*c*) Pass the rope diagonally back across the top of the load, through or under the third rope support, and pull the rope tight.

(*d*) Continue the process until the rear of the truck has been reached and secure the end of the rope.

(*e*) Using the second rope, start at the other front corner of the truck and repeat the procedure, using alternate lash hooks or rings.

(2) Towed loads are attached to their prime movers or towing vehicles by means of the lunette on the towed load placed in a pintle on the towing vehicle. The pintle latch must be closed and secured before the load is moved.

d. Safety of the load in transit.—After the load has been placed in or attached to his vehicle, the driver is responsible for its safety until the destination is reached.

46. Map reading.—Military motor vehicle drivers will receive sufficient instruction and training in map reading to enable them to follow routes on marked maps, to choose routes, and to recognize terrain features represented on topographic maps. Training will include the use of commercial highway maps, military topographic maps, military road maps, airplane photographs, and mosaics.

SECTION IV

MAINTENANCE

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47. General.—*a.* Proper maintenance is essential to economical operation of motor vehicles. This entails the coordination of maintenance functions. Those charged to the operating organizations embrace preventive maintenance, minor repairs, and unit replacement possible within the limits of the time available, utilizing hand tools and light portable equipment provided in Tables of Basic Allowances.

b. In the organization maintenance set-up, the driver and assistant driver are responsible for preventive maintenance functions within the limits of their ability and the equipment available for their use. Driver preventive maintenance functions include inspection, lubrication, tightening, servicing, and cleaning of motor vehicles, the avoidance of vehicle abuse, and the performance of emergency adjustments and repairs. Lubrication, tightening, servicing, and cleaning operations may be included under the general heading of caretaking.

c. Efficient enforcement of preventive maintenance is the responsibility of commanding officers of all units operating motor vehicles. In carrying out this function, definite maintenance duties will be assigned the motor vehicle operator, and he will be prohibited, except in an emergency, from performing any maintenance function not specifically assigned. (See AR 850-15.)

d. When operating conditions are particularly arduous, better results will occasionally be obtained by relieving drivers and assistant drivers of all inspection and care taking functions normally performed after operation, and requiring the maintenance section or other designated personnel to perform the duties. This practice should be resorted to only when absolutely necessary.

48. Servicing.—*a.* Servicing is defined as a check and necessary replenishment of gasoline, oil in crankcase, water or antifreeze in cooling system, and air in tires.

b. Precautions concerning the handling of gasoline must be rigidly enforced. When driver's trip tickets are used, the amount of gasoline should be entered on the ticket.

c. In the replenishment of oil in the crankcase, the following rules should be observed:

(1) Take every precaution to prevent dust and other foreign matter from entering the crankcase with the oil. Wipe out the oil measure, the spigot on the oil drum, the funnel, and the oil filler pipe with a clean cloth before refill oil touches any of the surfaces.

(2) Pour only the proper amount of oil into the crankcase. Do not overfill.

(3) Use the proper grade of oil for the season.

(4) Do not mix different makes of oil.

(5) Wipe off any oil spilled during refilling.

(6) When the driver's trip ticket is used, the driver enters on the ticket the amount of replacement oil used.

d. The water in the radiator should be maintained at the proper height below the overflow pipe. A hot engine should be allowed to cool before any considerable quantity of water is added to the radiator, or the engine should be allowed to run and the water added very slowly. In freezing temperatures, if no antifreeze is used, care must be exercised to prevent freezing. When the cooling system must be drained, it is necessary in most engines that the cylinder block as well as the radiator be drained. Clean water, preferably soft, should be used to fill the cooling system. If conditions make it necessary to use dirty water, the cooling system should be drained, flushed, and refilled with clean water at the earliest opportunity.

e. Tire inflation is discussed in paragraph 53.

49. Lubrication.—*a.* In decentralized lubrication, the driver will be held responsible for the lubrication of all parts that cannot be damaged by overlubrication except those requiring special lubricants. Parts that will be lubricated by the driver include spring and spring shackle bolts, spring pivot seats, steering knuckle pivots, steering knuckle tie rod pins, steering gear connecting rod (drag-link) ends,

clutch and brake pedal and brake lever pivots and linkage, accelerator linkage, door hinges and locks, tail gate hinges, and other slow motion friction surfaces.

b. Equipment furnished the driver includes a high pressure lubricator and an oilcan. The driver is responsible for the care and condition of this equipment.

c. Lubrication will be performed in accordance with a lubrication schedule and reports will be rendered by drivers when the lubrication is completed in order that proper records may be kept. Grease fittings and oil holes will be cleaned before lubricant is applied. Careful instruction and diligent supervision are necessary to assure good lubrication. Lubrication by the numbers is an effective method for teaching lubrication to untrained personnel.

d. Lubrication by drivers involves the use of only two types of lubricant: oil and chassis lubricant.

(1) The oil used for lubrication of linkages, hinges, etc., should be of the same grade as that used in the engine crankcase.

(2) The chassis lubricant used on spring and spring shackle bolts, steering knuckle pivots, etc., is of semifluid grease usually having a brilliant color and stringy consistency. Drivers are taught to distinguish between chassis lubricant and other types of lubricants.

50. Tightening.—*a.* The distinction between tightening and adjusting must be definitely understood, otherwise drivers will undertake operations which they do not have the knowledge, experience, or equipment to perform. In general, adjustment involves placing moving parts or assemblies in proper relative position and securing them in that position. Adjustments, except specified emergency adjustments, are prohibited to the driver. On the other hand, tightening consists of drawing up nuts and screws when adjustments are not involved.

b. When a driver discovers a loose or lost nut, bolt, screw, stud, or cotter key, he will tighten or replace it unless the adjustment of a part or assembly is affected. If adjustment is involved, report will be made to the chief of section or other designated individual.

c. A driver will be taught the correct use of the tools furnished for his use and the proper degree of tightness of the various nuts, bolts, and screws on his vehicle. If the drivers are not sufficiently skilled or if the proper tools are not furnished for their use, all tightening operations will be performed by the motor sergeant and mechanics.

51. Cleaning.—*a.* A motor vehicle should be cleaned after operation to prevent hardening of dirt accumulations and to keep dust and

other foreign particles from working into bearing surfaces. The body and exterior parts of the chassis should be washed, using a hose if available. Water should not be played on the engine as ignition troubles may result. Dirt should be wiped from the engine and its subunit assemblies. Gasoline should not be used to clean engines; cleaning solvent is recommended because of its greater safety. Gas and oil lines should *not* be polished. The use of paint on radiator cores is prohibited.

b. Vehicles should be inspected *before* being washed, because of the greater ease in detecting loose parts and assemblies, broken dust films being the best evidence of looseness. Scheduled lubrication should be performed *after* washing so that any water or dirt which has entered bearing surfaces may be forced out by the pressure of the new lubricant.

52. Care of tools and equipment.—The driver is responsible that tools, spare parts, pioneer equipment, chains, traction devices, towing cables, paulins, fire extinguisher, and other equipment furnished with his vehicle are in their proper places, are clean, and are in condition at all times for immediate use. Any equipment which becomes unserviceable will be repaired or replaced immediately. Shortages or unserviceable equipment will be reported to the chief of section or other designated individual.

53. Care of tires.—*a.* The chief responsibility of the driver in caring for tires is that of proper inflation. Tires will be inflated to recommended pressures and the pressure checked daily with a reliable gage. Air pressure cannot be determined satisfactorily by looking at the tire.

b. In general, tires should be removed from their wheels at least yearly to permit conditioning of wheel rim surfaces. Rim surfaces should be cleaned and covered with a protective coating to prevent rust. Wheels, including spares, should be changed periodically to secure uniform tire wear and to maintain resiliency in the spare tires.

c. When mounting tires on a motor vehicle, particular attention should be paid to sizes. In general, tires should be mounted in pairs; that is, tires of equal outside diameter should be mounted on the front wheels and those of equal outside diameter on the rear wheels of a 4 x 2 vehicle. However, on an all-wheel-drive vehicle without a center differential or other compensating device, all tires should have the same outside diameter. In order to maintain this condition after tires become worn, it may be necessary to transfer tires from one vehicle to another.

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d. When mounting dual tires, the worn tire should be placed on the inside. Tires differing more than ½ inch in outside diameters should not be mounted on the same wheel or on the same axle.

e. Drivers will be constantly alert to detect evidence of excessive or unusual tire wear. The most common causes of excessive tire wear are—

(1) Improper inflation, including under and over inflation and bleeeding.

(2) Poor driving, including fast starting and stopping and improper use of brakes.

(3) Rocks or other foreign material wedged between dual tires.

(4) Misalinement.

(5) Overloading and improper loading.

(6) Improper sizing of tires (different sized tires on the same axle).

54. Care of storage battery.—The motor vehicle driver will have a general knowledge of the functioning of a storage battery. He should know the correct ammeter reading for proper functioning of the generator and the general procedure to be followed when any abnormal reading is observed. He should know how to use the storage battery so as to prolong its period of usefulness. The following care by the driver will be routine:

a. Keep battery terminal connections clean and tight. Remove and clean corroded connections, using a weak alkaline solution if available. Dry the connections, apply a thin coating of vaseline or soft grease, replace and tighten the connections. Corroded terminal connections reduce storage battery efficiency and overload the generator

b. Keep the battery clean and securely clamped in the battery carrier.

c. Inspect the height of the battery electrolyte each week during summer and each 2 weeks during winter seasons. If the electrolyte is below the prescribed level, report the fact to the chief of section or other designated individual.

d. Report any unusual performance or battery condition immediately.

55. Duties during scheduled maintenance and technical inspections.—*a.* Before his vehicle is submitted for scheduled maintenance or technical inspection, the driver will correct such mechanical defects as are within the limits of his ability and the tools and equipment provided for his use. The vehicle will not be cleaned unless it is excessively dirty, since the dust film aids the mechanics in detecting defects.

b. The driver will report known mechanical defects which he is not authorized to correct and will accompany his vehicle while it is

undergoing scheduled maintenance or technical inspection in order to further knowledge of the mechanical condition of the vehicle and to permit the motor officer, or his representative, to point out results of improper operation or vehicle abuse and take proper corrective action.

56. Reports.—*a.* Driver's reports generally applicable to all arms and services operating and maintaining motor vehicles are (AR 850–15)—

(1) Driver's Report—Accident, Motor Transportation (Standard Form No. 26).

(2) Driver's Trip Ticket and Performance Record (W. D., Q. M. C. Form No. 237).

b. In case of injury to person or property, the driver of a motor vehicle will stop the vehicle and render such assistance as may be needed, complying with State and local regulations relative to reporting accidents. He will fill out immediately at the scene of the accident Standard Form No. 26 and deliver it to his commanding officer immediately upon return to his station. This must be done in every case regardless of how trivial the accident may appear to be or whether Government property or personnel only is injured (AR 850–15). Proper use of the accident report form protects the careful driver in that it presents data secured immediately after the occurrence of the accident and permits completion of an investigation before facts become distorted.

c. A properly completed driver's trip ticket furnishes valuable data for organization maintenance records as well as a written report of performance defects and emergency repairs effected. The report of defects protects the driver and puts the responsibility for repair on the shop maintenance personnel. When driver's trip tickets are not used, an oral report should be made by the driver.

57. Emergency roadside repairs.—*a.* Emergency roadside repairs are limited by the ability of the driver and the tools, supplies, and equipment available for his use.

b. In performing emergency repairs, the driver should not force any part nor attempt the repair unless he is reasonably certain that he has diagnosed the trouble correctly. Tampering with mechanisms is prohibited. At the first opportunity after an emergency repair has been effected, the driver will report the fact to his chief of section or other designated individual in order that proper action may be taken. The following are examples of emergency roadside repairs which a driver will be permitted to perform after he has received proper training:

(1) Remove, clean, reset, and install spark plugs.

(2) Adjust fan belt.

(3) Remove, blow out, and install gas lines.

(4) Tighten nuts and/or cap screws around leaky gaskets.

(5) Tape leaks in gas or oil lines and tighten connections.

(6) Drain and clean the sediment bowl of the carburetor or fuel pump.

(7) Tape electrical lines.

(8) Plug leaks in the cooling system and tighten water-pump connections.

(9) Straighten tie rods and steering linkage.

(10) Loosen tight brakes.

58. Inspection before operation.—A motor vehicle is not ready for service until certain items have been checked. Before moving his vehicle from its overnight parking position, the driver, under proper supervision, makes this inspection and reports the results to his chief of section or other designated individual. The driver is held strictly responsible that all requirements are met. Items are checked as follows:

a. Before starting engine:

(1) The surface (ground or floor) under the vehicle for evidence of leaks.

(2) The radiator for proper amount of water and to see that air passages are open.

(3) The crankcase for proper amount of lubricating oil. Spare oil if required.

(4) The engine for loose parts or electrical connections.

(5) The gasoline tank for proper amount of gasoline.

(6) The fan belt for proper tension.

(7) Drain valve in air-brake storage tanks closed.

(8) Hand brake set and all transmissions and power take-offs in neutral.

b. After starting engine and during warm-up period:

(1) The proper functioning of all dashboard instruments, including air-pressure gage, as engine comes to operating temperature.

(2) The horn and all lights for proper functioning.

(3) The action of the windshield wiper.

(4) Fan operation.

(5) The engine for loose parts and unusual noises.

(6) The front axle and steering linkage.

(7) The tools and necessary equipment, including fire extinguisher.

(8) The carried load for condition and distribution.

(9) The towed load for condition, attachment to truck, and brake connections.

(10) Pneumatic tires, including spares, for proper condition and inflation.

(11) Wheels for tightness.

(12) Springs for condition.

(13) Recheck for water, oil, and gasoline leakage.

(14) Move vehicle and test the clutch, transmission, steering, and brakes.

59. Inspection during operation.—*a.* During operation the driver will be alert to detect malfunctioning of the engine. He will be trained to detect unusual engine sounds or noises and to follow the proper procedure when they occur. He will glance frequently at the instrument panel gages and know what to do when abnormal readings are observed. The most common abnormal readings are—

(1) Ammeter showing discharge when engine is running.

(2) Oil pressure gage showing either a low reading or the needle fluctuating.

(3) Temperature gage reading 200° F.

(4) Gasoline gage failing to show correct amount of gasoline.

(5) Air gage reading less than 70 pounds.

b. Only under exceptional circumstances will a motor vehicle be operated after trouble has developed which will prove serious if operation is continued. When in doubt, the engine should be stopped and assistance obtained. Inspection during operation applies to the entire vehicle and should be emphasized throughout the driving instruction period.

60. Inspection at the halt.—At each scheduled halt during the march or at intervals during a day's work on dispatch, the driver will make a careful inspection of his vehicle to determine its general mechanical condition. Detection and correction of defects will give reasonable assurance that the vehicle is ready for continued operation. If the defects cannot be corrected during the halt, proper disposition of the vehicle will be made so that unnecessary delay may be avoided and a major failure prevented. Drivers and maintenance personnel will make full use of halt periods to place all vehicles in condition for continued uninterrupted service. A suitable general routine, the sequence of which may be altered to suit a particular type of vehicle, is as follows:

a. Allow the engine to run a short time. Listen for unusual noises.

b. Feel brake bands, wheel hubs, and gear cases for evidence of overheating.

c. Check all items included in inspection before operation.

d. Report promptly the result of the inspection to the chief of section or other designated individual.

61. Inspection after operation.—At the conclusion of the day's work, the driver will make an inspection similar to that made at halts but more thorough and detailed. Repair operations performed by the driver are determined by his ability and the equipment available for his use. If defects cannot be corrected, they will be reported promptly to the chief of section or other designated individual. The inspection will be followed by preventive maintenance. A suitable routine is as follows:

a. Check all items included in the inspection at the halt.
b. Check body bolts; tighten or replace as required.
c. Drain air tanks.
d. Report results.

NOTE.—The above inspections should be modified as necessary for full- and half-track vehicles; for special equipment, such as traction devices for wheeled vehicles; and for vehicles designed for special purposes.

SECTION V

DRIVING INSTRUCTION

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62. General.—During the driving instruction period the driver must learn the correct performance of his duties and to form the proper habits.

63. Motor vehicle controls.—The day-to-day condition and the ultimate service of a motor vehicle, as well as safety to life and property, depend upon the condition and proper use of the controls. Consequently, instruction and supervision are necessary to insure the correct use of these important devices. The following controls will be explained and demonstrated:

a. Carburetor choke control (if not automatic).
b. Carburetor throttle control, to include accelerator.

c. Ignition switch.
d. Spark control (if not automatic).
e. Transmission gear shift lever.
f. Transfer gear shift lever.
g. Clutch pedal.
h. Steering wheel.
i. Brakes, hand and foot.
j. Power take-off and winch controls.
k. Front-wheel throw-out lever.

64. Aids to motor vehicle control.—Although the devices given below cannot be classed as controls, they aid in motor vehicle control and will be explained and demonstrated.

a. Light switches.
b. Horn button.
c. Rear-view mirror.
d. Windshield wiper.
e. Speedometer.

65. Instrument-board gages.—Gages are placed on the instrument panel in plain view of the driver to give information concerning certain assemblies and systems of the motor vehicle. The instructor will explain the purpose of each gage, give its normal reading, and tell the driver what to do when an abnormal reading is observed.

66. Starting and warming up the engine.—*a.* Special attention will be paid to the proper starting and to the warm-up period in order that unnecessary engine wear may be prevented. The following procedure is satisfactory under average operating conditions:

(1) Make the prescribed inspection before starting engine (par. 58*a*), including setting the hand brake and placing all transmissions and power take-offs in neutral.

(2) Set the choke control and the hand throttle control. Consider the peculiarities of the engine, engine temperature, fuel, and manufacturer's instructions. Care should be taken to avoid excessive use of the choke.

(3) Disengage the clutch.

(4) Turn on the ignition.

(5) Engage the starter switch contacts. Release the starter switch contacts as soon as the engine starts.

(*a*) If the starter device fails to engage the engine flywheel, release the starter switch contacts and allow the starter armature to come to rest. Try again. If the device still fails to engage, report to the chief of section or other designated person.

(*b*) If the starter device engages the engine flywheel and locks, release the starter switch contacts, turn off the ignition, place the

transmission in high gear, release the brake, and rock the vehicle backward. If the starter device fails to disengage, place the transmission in neutral and report as above (not applicable to half- or full-track vehicles).

(*c*) If the starter device engages the engine flywheel and the engine fails to start after several attempts, note whether or not the ammeter needle fluctuates, then report as above.

(6) If the engine is magneto equipped and hand cranking is necessary, follow the manufacturer's instructions.

(7) Adjust the setting of the dash throttle control to give the desired engine speed. Release the clutch pedal.

(8) Allow the engine to warm up to the proper operating temperature, opening the choke as rapidly as the engine temperature permits. *The choke should be closed, or partially closed, only as long as necessary and should never be used excessively.* The engine has reached a safe operating temperature when upon acceleration there is no backfiring, and when the oil pressure needle remains below the maximum reading on the oil pressure gage scale with the engine running at its normal operating speed. In case an abnormal reading is noted, an immediate report will be made.

b. Some engines, when stopped after reaching an operating temperature, radiate enough heat to cause boiling of the gasoline in the carburetor float chamber. This condition, which is not uncommon during hot-weather operation, causes a rich mixture in the intake manifold. To start the engine, the hand throttle is fully opened, the carburetor choke is left in the normal operating position, and the engine started. The throttle should be adjusted to the desired engine speed only after the engine begins to run smoothly. Intermittent depression of the accelerator when the engine is not running will also produce a rich mixture in the intake manifold. The procedure outlined above will be followed in starting the engine.

67. Clutch, transmission, and brakes.—*a.* Drivers familiarize themselves with the location and manipulation of the clutch pedal, the transmission gear shift lever, and the brake lever and brake pedal before actual driving instruction starts. For this purpose the motor vehicles should be blocked up securely with all wheels off the ground.

b. When the candidate first gets into the driver's seat, he will assume the correct position; that is, sit erect, without stiffness, squarely behind the steering wheel; head erect, eyes looking to the front; hands on opposite sides of the steering wheel, on a horizontal line generally through the center of the wheel, grasping the steering wheel rim firmly but without tenseness; both feet flat on the floor boards except when actually manipulating the accelerator, the clutch

and brake pedals, or the starter switch. *The feet should be placed on the control pedals only when the pedals are to be operated.*

c. After the candidate has familiarized himself with the location and manipulation of the controls, he will demonstrate the operation of the accelerator; coordinated movements of the accelerator, clutch pedal, and transmission gear shift lever; gear shifting, to include reverse; operation of the brake controls; manipulation of the steering wheel; the use of the engine as a brake; and practice in manipulation of the controls until he becomes reasonably proficient.

68. Gear shifting and use of clutch.—*a. General.*—Preliminary instruction is conducted on a large open field where steering is of secondary importance. Candidates are permitted to drive at will with the transmission in the lower gear ratio until they are reasonably familiar with the operation and control of their vehicles, after which the driving becomes progressively more difficult.

b. Shifting from a lower to a higher gear.—In shifting from a lower to a higher gear without double clutching, the following operations are performed:

(1) Disengage the clutch and at the same time release the accelerator. The operation of the clutch and the importance of completely disengaging it should be understood.

(2) Shift to the next higher gear. The gear shift lever should be moved smoothly but firmly; it should never be forced.

(3) Engage the clutch and at the same time accelerate the engine.

(*a*) The clutch must be released gradually from the time it starts to engage until it is fully engaged. Since the clutch action takes place during a relatively short movement of the pedal, the driver must know the point at which engagement starts. He can then increase the engine speed to balance the engine load. He must also know the injurious effects of allowing the foot to remain on the clutch pedal ("riding the clutch").

(*b*) The engine should be accelerated enough to move the load off smoothly, but it should not be raced. During the preliminary instruction period the accelerator may be blocked to prevent excessive engine speed.

c. Shifting from a higher to a lower gear.—After the driver has become reasonably proficient in shifting from lower to higher gears, he will receive instruction in shifting from higher to lower gears, using double clutching. The procedure is as follows:

(1) Disengage the clutch and shift to neutral; at the same time accelerate the engine.

(2) Engage the clutch and accelerate to an engine speed slightly in excess of that required in the lower gear to maintain the vehicle speed.

(3) Disengage the clutch and shift to the next lower gear; at the same time slightly decelerate the engine.

(4) Engage the clutch; at the same time accelerate the engine to effect clutch engagement without shock to the power transmission system.

(5) Practice double clutching until proficient in shifting from a higher to a lower gear.

d. Shifting gears on medium and heavy trucks.—On medium and heavy vehicles it is sometimes difficult to shift from a low gear to a higher gear without clashing the gear teeth. The clashing may be avoided by using the double-clutching procedure *without accelerating the engine during the shift.*

69. Use of transmission and auxiliary transmission.—*a.* A transmission is provided so that the engine may be permitted to run at a speed at which sufficient horsepower is developed, and at the same time permit the vehicle to travel at a speed commensurate with the road and load conditions. The addition of an auxiliary transmission, sometimes included as a part of the power transmission system, increases the number of gear ratios available and permits greater flexibility in the transmission of power.

b. Drivers must understand what happens when the gear shift lever is moved and must be practiced in the manipulation of the controls and the proper use of the transmission and auxiliary transmission. An engine must never be permitted to labor unduly when a change in transmission-gear ratios would lighten the load. If his vehicle is equipped with a tachometer, he must know the proper engine speeds for efficient operation.

c. The auxiliary transmission normally provided on military motor vehicles has two gear ratios: high, which does not change the gear ratios provided by the main transmission; and low, which gives a greater gear reduction (higher reduction ratio) than that provided by the main transmission. The auxiliary transmission is controlled by a gear shift lever in the driver's compartment. The high range is used for normal operation and the low range for heavy duty. *The ratios in the auxiliary transmission of most type of vehicles should not be changed when the vehicle is in motion.*

70. Use of brakes.—*a.* The brakes should be in such condition that a hard application will cause all wheels to be locked, but the driver must realize that the maximum retarding effect occurs just before the wheels lock. Intermittent applications will reduce the wear of brake linings and drums. Application of the brakes should be gradual and with just enough force to accomplish the desired result.

b. Judicious use of the braking effect of the engine will increase the serviceable life of the brake linings and drums. When the driver anticipates a stop, he should make full use of the engine braking effect, disengaging the clutch in time to avoid stalling the engine. When descending hills, a driver should use the engine as a brake by selecting and engaging the proper gear ratio, and use the intermittent application of the brakes to prevent overspeeding the engine. The ignition should not be turned off. The engine speed when descending a hill should be no greater than the speed necessary to ascend the hill when using the same transmission gear ratio. On steep hills the gear train necessary to give the desired results should be engaged before the vehicle is committed to the hill. Attempting to shift gears after the vehicle has started down a steep slope may result in a runaway vehicle.

c. At all times a driver should know the performance and the general condition of his vehicle brakes. When operating conditions require vehicles to move through water, the brakes become very inefficient because of moisture on the brake linings and in the brake drums. If the distance to be traversed is short, considerable water may be kept out of the brake assemblies by a slight application of the brakes while the vehicle is in the water. After passing through water, the brakes should be set slightly and the vehicle operated until sufficient heat has been generated to dry the brakes.

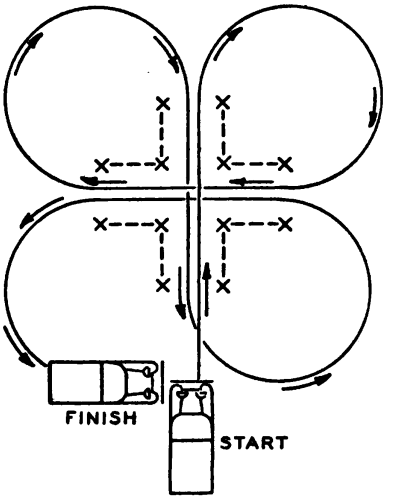
d. Vehicle stopping distances are dependent upon the nature and condition of the road surface, the condition of the brakes, the weight of the load, and the kind and condition of tire treads. When operating at a speed of 20 miles per hour on a dry, smooth, level road free from loose material, every motor vehicle or combination of motor vehicles should be capable at all times, and under all conditions of loading, of stopping within the following distances when the foot brake is applied:

Vehicles or combination of vehicles having brakes on all wheels	30 feet
Vehicles or combination of vehicles not having brakes on all wheels	45 feet

e. Drivers are cautioned against the use of brakes when a vehicle is skidding and when it is being operated on ice-covered roads.

71. Turning, backing, and parking.—*a.* After the driver has acquired facility in starting, simple driving, and stopping his vehicle, he will be practiced in maneuvering in difficult places. The ability to turn his vehicle in a confined space, to back it accurately, and to park it properly under various conditions is an essential requirement for the motor vehicle driver.

b. Turns should be made at speeds commensurate with the load, road, and traffic conditions. The driver should always give the appropriate arm, electrical, or mechanical signal in sufficient time to afford ample warning that a change in direction is to be made. He should keep at least one hand on the steering wheel when the vehicle is in motion. Turns should be made with as little confusion to other traffic as possible. On two-lane highways, all turns should start and end in the right lanes. On multiple-lane highways, right turns should start and end in the extreme right lanes; left turns should start and end in the lane just to the right of the center line. The driver should place his vehicle in the proper lane some distance before reaching the turn in order to avoid the possibility of accidents.



(The figure should be symmetrical, with the stakes placed to allow an over-all side clearance of approximately 18 inches.)

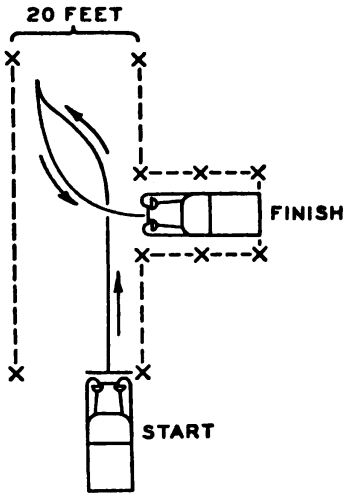
FIGURE 36.—Reverse turning course.

c. A driver should never back a vehicle until he is certain that the way is clear. When the driver's view is obstructed, he should act as directed by an assistant on the ground. When backing unassisted, the driver should always give warning of the movement by sounding his horn. Considerable practice is necessary to back a vehicle safely and accurately. This is particularly true when the driver is required to back a towed load.

d. Parking includes turning and forward or backward movement of the vehicle in more or less restricted spaces. Factors which should be given consideration when parking are space for maneuver of vehicle, solid standing, interference with other traffic, and cover if applicable.

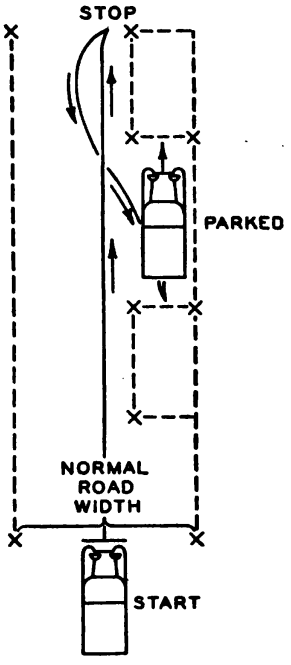
e. The use of stake driving courses will permit instruction and practice without other traffic interference and will make closer supervision possible. Suitable instruction courses are shown in figures 36, 37, and 38.

72. Difficult driving.—*a.* After the driver has acquired facility in driving and maneuvering, he will be taken through a series of progressively increasing difficulties, such as ditches, ruts, chuckholes, woods, slippery roads, mud, difficult curves, and up and down steep



(The figure should be symmetrical, with the stakes placed to allow an over-all side clearance of approximately 18 inches.)

FIGURE 37.—Backing course.



(Stakes should be placed so that when parked the vehicle will have an over-all longitudinal clearance of approximately 10 feet and a lateral clearance of approximately 3 feet.)

FIGURE 38.—Parking course.

slopes until he becomes reasonably proficient in handling his vehicle under all conditions. This training will include field expedients and the application and use of chains and traction devices.

b. The training will start with individual performances and empty vehicles and will progress to group performances with loaded vehicles and with towed loads if used in the organization.

73. Night driving.—*a.* Movements under cover of darkness are frequently necessary in order to escape observation and gain security. In forward areas, movements must be made without lights if casualties are to be minimized and secrecy preserved. Night movements are particularly difficult because of the limited control that can be

exercised and the obstacles that must be overcome. Before such movements are undertaken, drivers will be given thorough training in marching, with and without lights.

b. Training in night driving will start with empty vehicles operated over good roads with lights. Careful instructions are issued and the road will be well marked. After the drivers have become reasonably skilled in driving with lights, they are required to traverse the same route without lights. Provision is made to prevent flashing of the stop light. The routes traversed become progressively more difficult until drivers are proficient in handling their vehicles under all probable operating conditions. During this training, special attention is paid to march discipline, to the prevention of smoking, and the use of lights. When a movement with lights is to be continued without lights, time will be allowed to accustom drivers' eyes to the changed conditions.

74. Marching.—*a.* Successful marching requires well-trained drivers and teamwork on the part of all elements of the command. Drivers must therefore be trained in march organization, march formations, march regulations, camouflage and concealment of vehicles, and procedure in case of air or mechanized attack. Through instruction and the enforcement of regulations, a degree of march discipline is attained which enables an organization to pass over roads with a maximum of speed and safety and a minimum of interference with other traffic, and to arrive at its destination in the best possible condition.

b. During training in close-column marching, special attention will be paid to safe driving distances between vehicles. These distances, which vary with vehicle speeds, will be prescribed initially. After training and experience under continual supervision, the driver will be permitted to drive at the distance he considers safe. The controlling element in the determination of safe driving distance is the ability to avoid collision with the vehicle ahead without the excessive or sudden use of brakes. In order to pass certain bottlenecks at the maximum road density, it may be necessary temporarily to decrease the distances below those considered the minimum for safe driving under normal conditions. The following rule, properly modified to meet special conditions, gives the minimum distances for safe marching: *The distance in yards between vehicles should be twice the speedometer reading.*

SECTION VI

EXAMINATION AND OPERATOR'S PERMIT

	Paragraph
Examination	75
Operator's permit	76

75. Examination (AR 850-15).—Motor vehicle operator's permits will be isued only to individuals who have satisfactorily passed an examination conducted by a qualified commissioned officer covering the following subjects:

a. Mechanical.—Nomenclature and functions of major units of the motor vehicle.

b. Operation.—(1) Actual driving of the vehicle, involving use of controls, reversing, and parking under usual conditions of traffic and terrain.

(2) Traffic regulations, road procedure, safety precautions, speed limits, and vehicle abuse.

c. Maintenance.—First echelon (vehicle operator's) maintenance.

76. Operator's permit (AR 850-15).—*a.* W. D., Q. M. C. Form No. 228 (U. S. Army Motor Vehicle Operator's Permit) will be issued by commanding officers to all enlisted and civilian operators of military motor vehicles.

b. Possession of a motor vehicle operator's permit should be a guarantee that the individual is a safe driver. Accordingly the permit will be immediately revoked when an accident or other cause so warrants.

SECTION VII

FIELD EXPEDIENTS

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Wheel mats	83
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Prolonge	86
Block and tackle	87
Towing bars	88
A-frame	89
Deadman installation	90
Anchored stake	91
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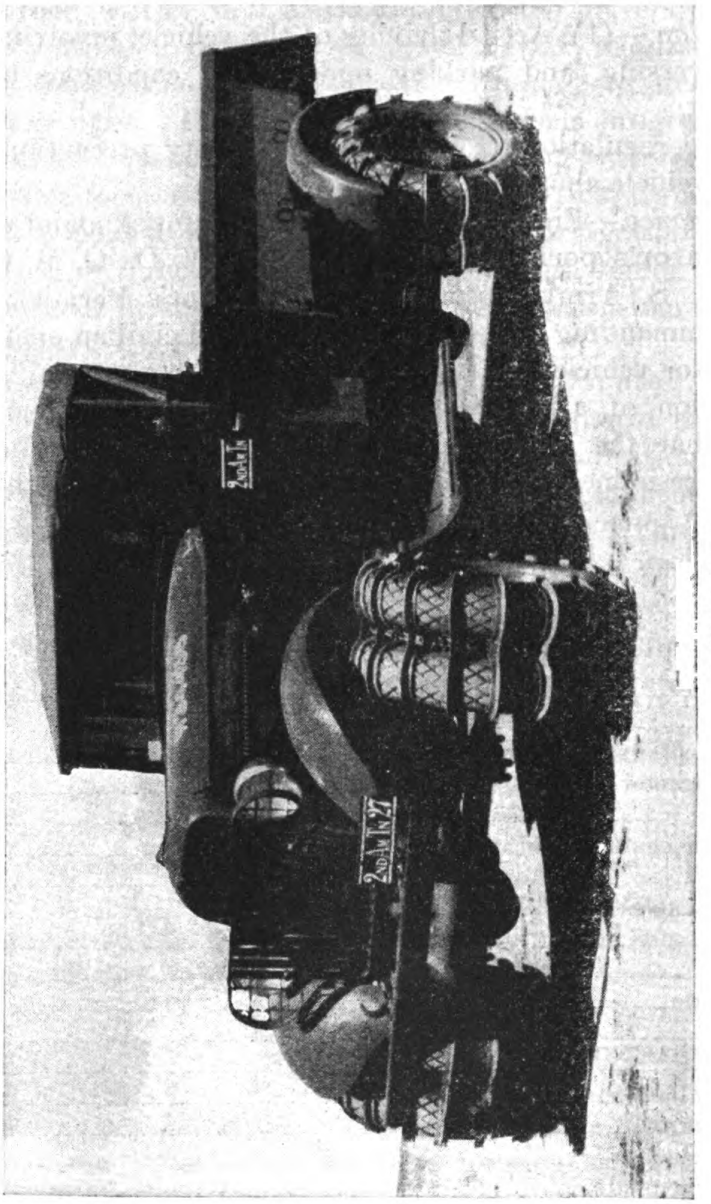
77. Traction devices (fig. 39).—The use of traction devices, such as chains, lugs, traction bands, and dual wheels, is covered in paragraph 44.

78. Trouble truck.—Although equipment in different types of motorized units will vary, each organization should have one trouble

truck, usually equipped with a winch. The use of the winch or trouble truck is governed by the following procedures:

a. Although normally placed at the rear of the column, when need for the winch truck can be anticipated, the truck should be brought forward and taken across the obstacle as the first vehicle.

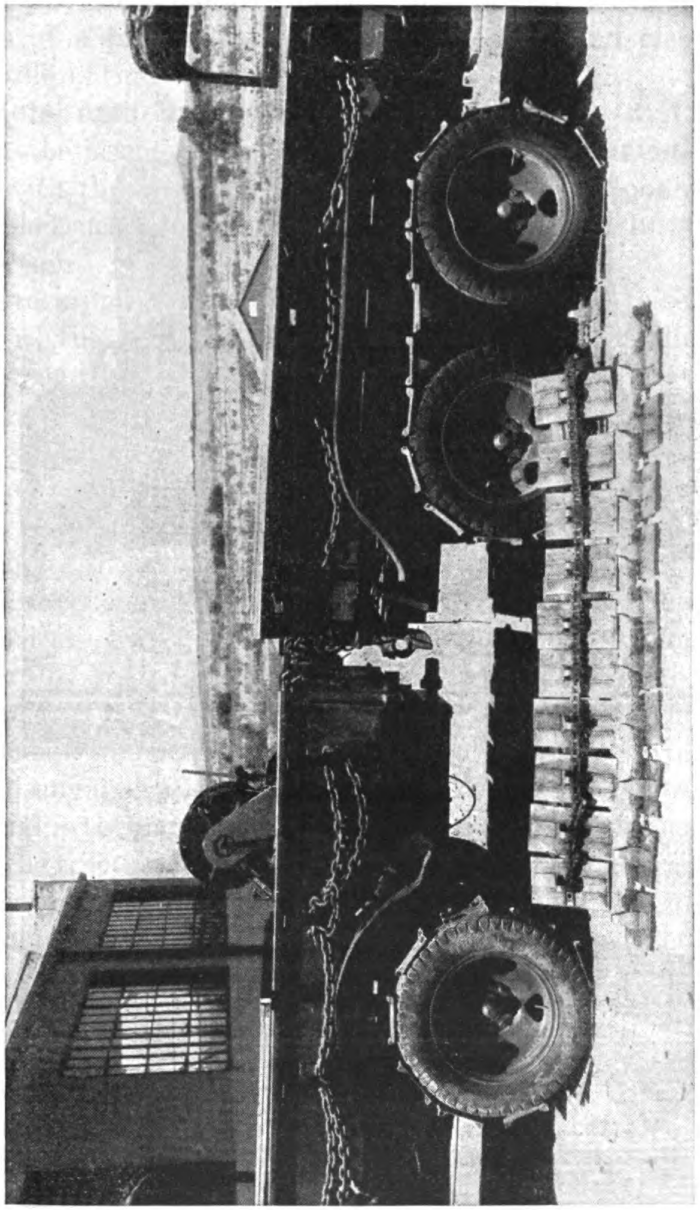


① Giant lugs.

FIGURE 39.—Traction devices.

b. When necessary, the winch truck is backed across an obstacle under the assisting power of the winch with cable attached to a deadman or tree. The power of the drive wheels should assist the winch, but the gears must be so chosen that the wheels will cover ground faster than the winch cable is pulled in.

c. The same procedure should be applied when pulling in a vehicle with the winch; that is, the towed vehicle should assist with its maximum traction. The best power combination generally results if the winch is operated in the highest gear that will give sufficient power and the towed truck is pulling in lowest gear.

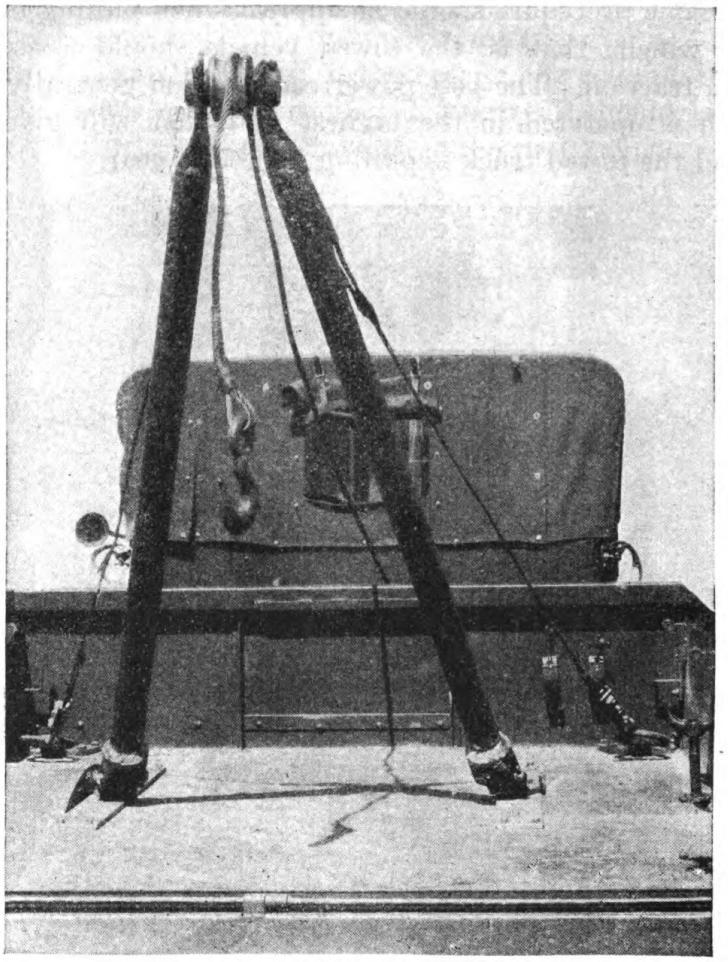


② Traction bands.

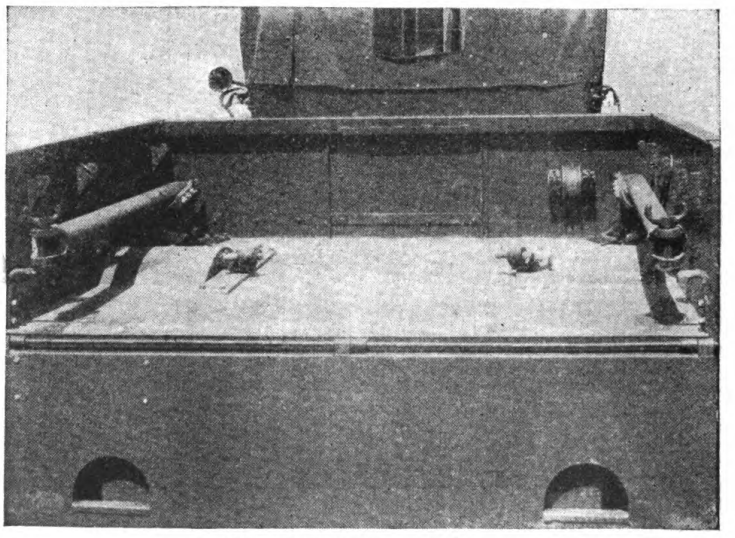
FIGURE 39.—Traction devices—Continued.

d. After the winch truck has crossed an obstacle, the cable may be run out, the winch locked, and the truck used as a towing vehicle, or the truck may be halted and the winch utilized.

e. When the winch is used on a difficult pull, the winch truck may be held in place by use of the brakes, wheel blocks, or by anchoring



① In position for use.



② In traveling position.

FIGURE 40.—Wrecking crane.

to a tree or deadman. Traction devices will assist in holding the vehicle in place.

f. Certain precautions are necessary in the proper use of the winch cable. Whenever the towing cable is slipped over the ground it should be protected by placing pieces of wood under it. Power must be applied to the cable gradually. As a precaution against the lashing ends of a broken cable, all men should stand clear before the winch cable is tightened.

79. Hoist attachment and wrecking crane.—*a.* A hoist attachment may be issued to units. This equipment is intended primarily for use with the maintenance section. It may be mounted in either the trouble truck or the tender carrying the equipment of the maintenance section.

b. A wrecking crane (fig. 40) may be improvised to serve the same purpose as the hoist attachment. The crane is installed so that it extends over the tail gate approximately 4 inches. The winch cable is placed over the crane only when necessary to get an upward towing lift.

c. Either the hoist attachment or the wrecking crane will assist in towing a disabled vehicle in an elevated position when the steering mechanism or the axle is damaged. They may often be of use to give a towing lift on a mired vehicle. Care must be taken not to attempt to lift too heavy loads, which will nose-up the hoisting vehicle.

80. Track-laying tractor.—Where available tractors will serve as powerful towing expedients. They have good flotation and powerful traction. Once the tracks begin to slip, the clutch should be quickly disengaged and the tractor moved out in the opposite direction. A new trial is then made on new footing, inserting a tow chain or cable between the tractor and towed load if necessary. The tractor has little if any more hill-climbing ability than a truck. When needed as a tow in such cases it should be moved to a position where it can pull without climbing a steep slope.

81. Grouser bar (fig. 41).—For track-laying vehicles, grouser bars may be improvised. A grouser bar is installed across both tracks by means of the grousers after the vehicle is stalled in a mired position. The vehicle is rolled over it and the bar removed before it strikes the back of the vehicle. A pole or piece of timber may be secured across the tracks to serve the same purpose.

82. Grouser rope or chain and lug plate (fig. 42).—Improvised single grouser ropes or heavy single chains may be carried when a driver is operating a passenger vehicle alone. If the vehicle stalls on a muddy road, the traction of one or more wheels may be increased by the use of these devices. Makeshifts, such as a short piece of rope

or web belts, may be used for the same purpose in case of an emergency. These should be applied only after chains have failed to give sufficient traction.

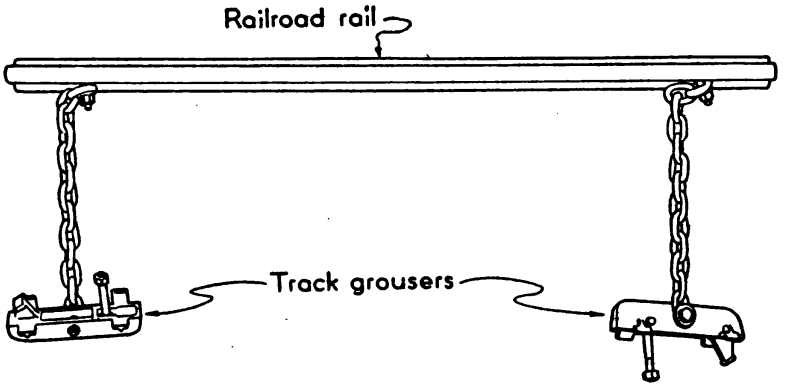


FIGURE 41.—Grouser bar.

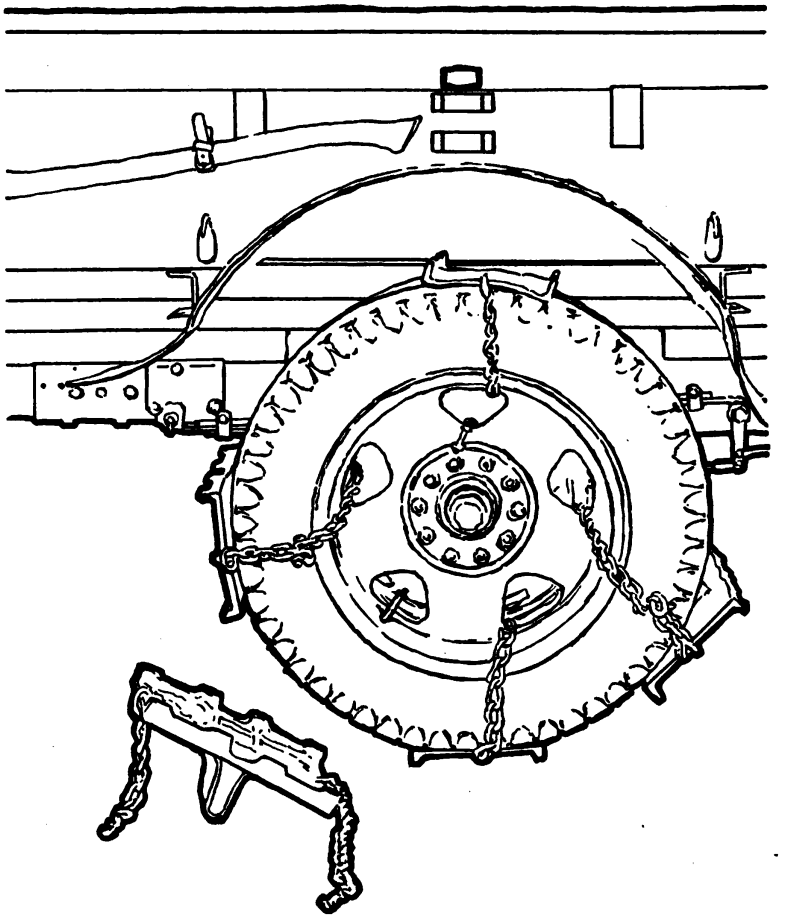


FIGURE 42.—Lug plate.

83. Wheel mats.—Flat mats improvised by braiding together strands of rope, or pieces of heavy canvas with ropes attached to the

four corners, are useful to place under the wheels where the going is soft. When a vehicle is stalled with wheels slipping, wheel mats may be used by attaching them to the wheels at one end, or they may be laid down in front of the wheels with the end away staked down. To increase traction over a soft or slippery spot, one or several of these mats may be tied end to end. They may then be staked down or maneuvered ahead of the wheels. Sacks or, in an emergency, blankets and like articles may be used to serve the same purpose.

84. Tow chains or cables.—Tow chains or cables should be about 25 feet long and should have a hook on one end and a ring or loop on the other. Cables and chains ⅜ to ½ inch give sufficient strength.

85. Spreader bar (fig. 43).—To prevent the frame from being bent inward in front, improvised spreader bars should always be used to attach a cable or tow chain to both tow hooks.

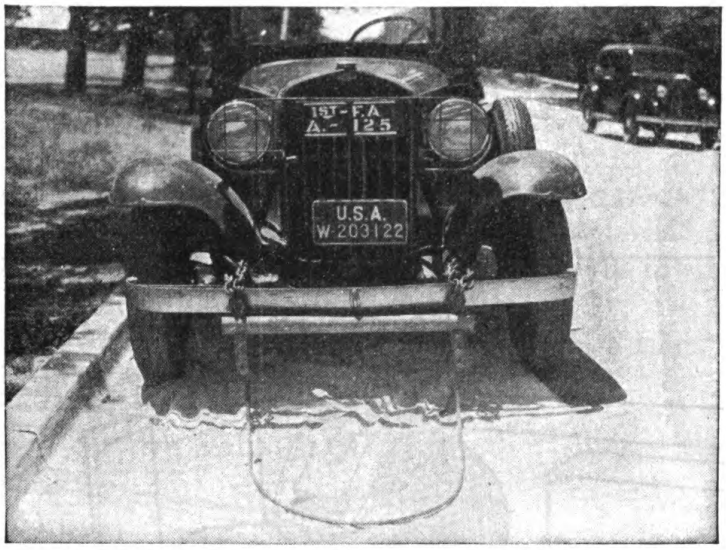
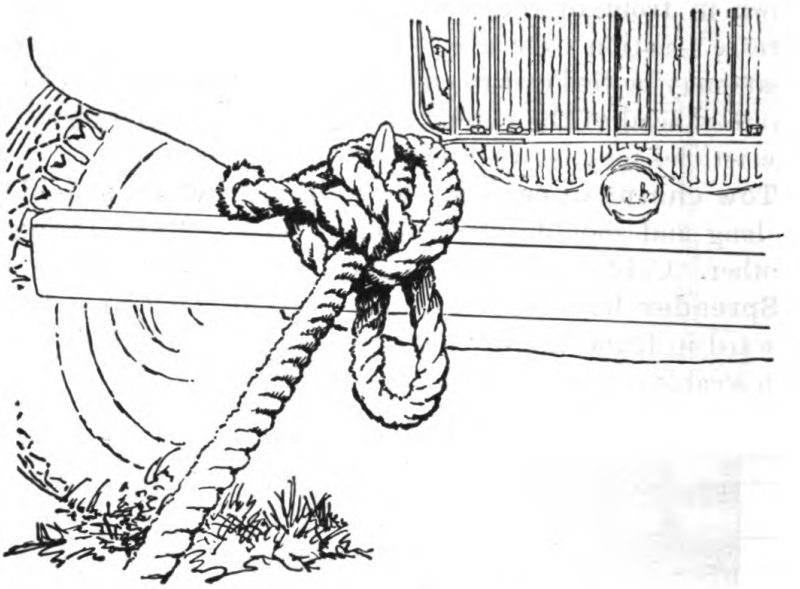


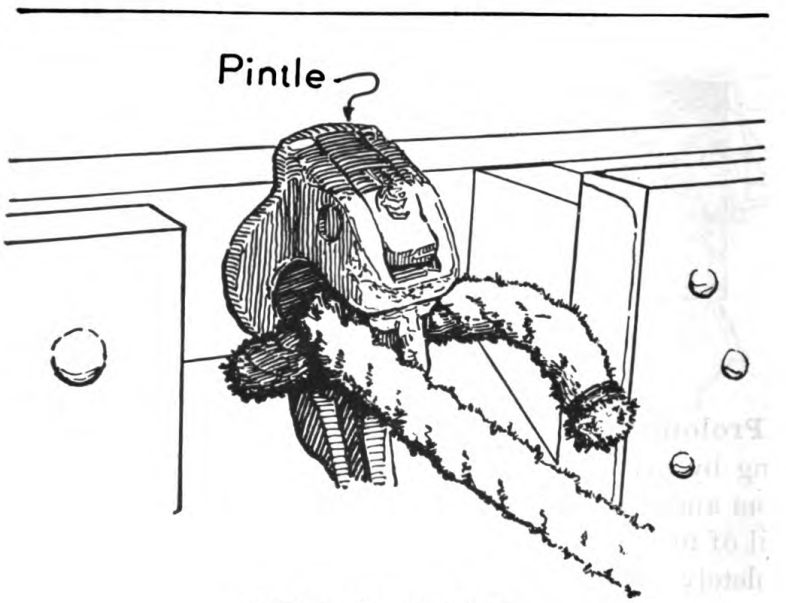
FIGURE 43.—Spreader bar.

86. Prolonge.—A prolonge is made from a piece of rope about 30 feet long by making a loop at one end. With this, manpower or a tow from another vehicle may be most efficiently and quickly applied. A detail of men may drop a prolonge over a tow hook before a vehicle is completely stalled and help it past a difficult point. Tow ropes can most safely be attached to tow hooks, pintles, or around the spring shackle. Knots easily untied, such as the clove hitch with end left through to form a bow, should be used. The double Blackwall knot for attachment to tow hooks and the single Blackwall knot for attachment to the pintle are the easiest to untie, but may occasionally slip

(fig. 44). A 1-inch rope will safely stand a tension of about 1 ton. Larger or smaller ropes increase or decrease in safe tension limits



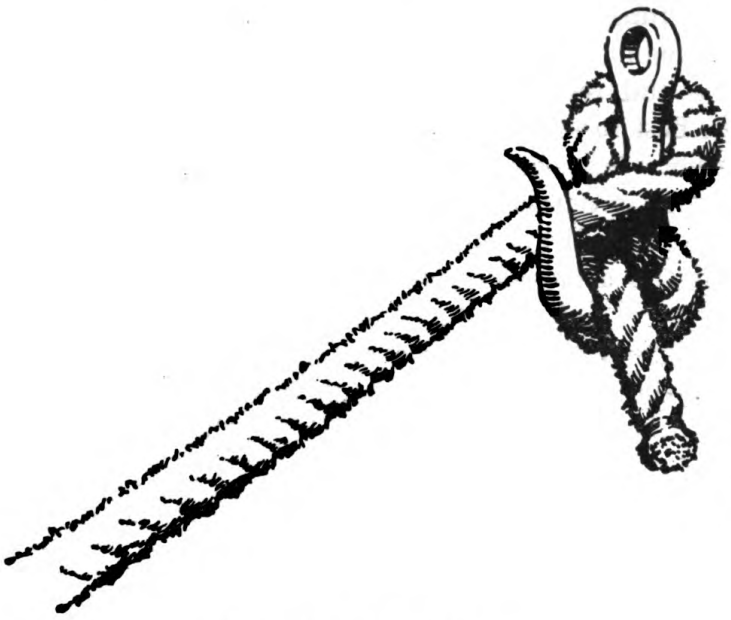
① Clove hitch (end not pulled through).



② Single Blackwall knot.

FIGURE 44.—Knots.

by 500 pounds for each ⅛-inch difference in size from a 1-inch rope. The vehicle being towed should always assist with its own power.



③ Double Blackwall knot.

FIGURE 44.—Knots—Continued.

87. Block and tackle.—Where a winch truck is not available, a block and tackle is carried in the trouble truck. Attached to a tree, anchored stake, or deadman, it is useful to multiply the towing power of either manpower or a towing vehicle.

88. Towing bars (fig. 45).—Towing bars are used when a vehicle is to be towed.

FIGURE 45.—Towing bar.

89. A-frame (fig. 46).—An A-frame is an expedient which combines both a lift and a tow. It is easily constructed with two poles approximately 12 feet long and two tow chains or cables. Holes are dug as supports for the foot of the frame, or a cross chain or plank is used to prevent the poles from spreading. Care must be taken to place the A-frame far enough away from the towed vehicle so that, when it is lifted over, the foot of the legs will not damage the front of the vehicle. This simple device is a useful expedient when a wrecking crane or hoist attachment is not available to lift a vehicle out of and over a ditch or hole. It is also of use when a heavy vehicle is completely mired.

90. Deadman installation (fig. 47).—The procedure of installing a deadman is to utilize as much surface of undisturbed earth as possible and to prevent the tendency to rotate out of position. To get the best results the following points are essential:

a. Position.—A position for the deadman is best if chosen at least a yard behind a natural crest or mound. It should be far enough back so that it will not interfere with the vehicles clearing the obstacle, and the attached cable or chain will not exert an upward pull.

b. Digging.—A hole is dug about 1 foot deep and long and wide enough for the deadman. The bank in the direction of pull is cut straight and is slanted away about 15° to the vertical. The bottom

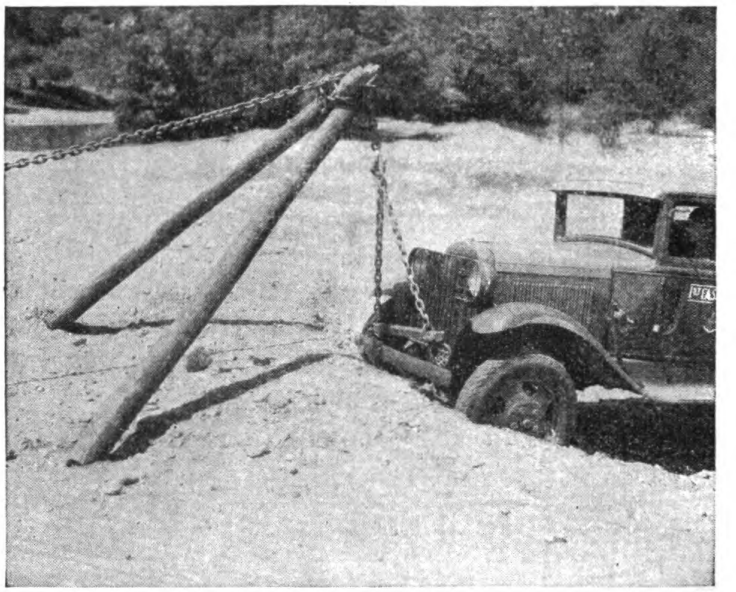


FIGURE 46.—A-frame.

of the hole is cleared at a right angle to this bank. To assist in strengthening the top edge of the hole on the side in the direction of pull, two stakes are usually driven on either side of the cable at a slightly greater angle to the vertical than the bank. They are driven flush with the slanted bank near the top. A trench for the cable is cut from the hole through the crest of the hill or mound. This should be slightly deeper than the bottom of the hole at the beginning and should continue out in a descending slope.

c. Cable attachment.—A rectangular tie or larger timber of the type used for a wheel block is most suitable for the deadman, since it presents the maximum surface to oppose the direction of pull. The cable or chain is attached to the deadman so that the largest

dimension is vertical and the pull on the cable is exerted along the bottom surface.

91. Anchored stake (fig. 48).—Two stakes and a rope lashing may be used to install quickly an anchored stake which will withstand considerable tension. The first stake is driven into the ground at a little greater than a right angle from the direction of pull. The

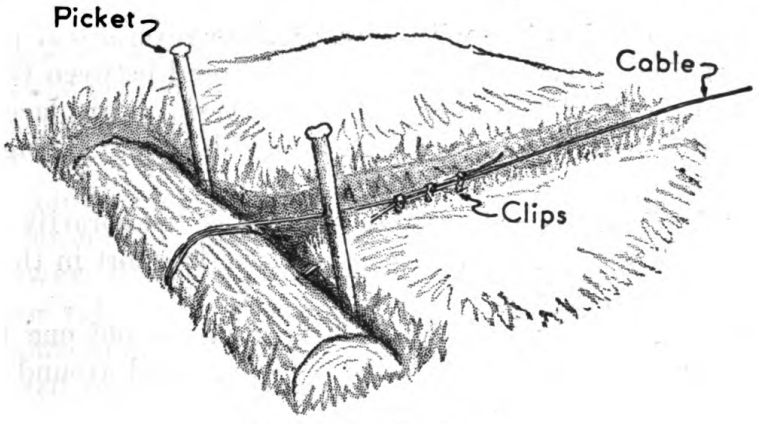


FIGURE 47.—Deadman.

second stake is driven at an angle slightly closer to the ground at 3 to 6 feet away from the direction of pull. A rope is used to anchor the top of the first stake to the bottom of the second. In order that this rope will not slip down on the first stake, it is first tied to the bottom of the second, then wrapped over itself with a one-half clove hitch at the top of the first stake. The rope then is passed around

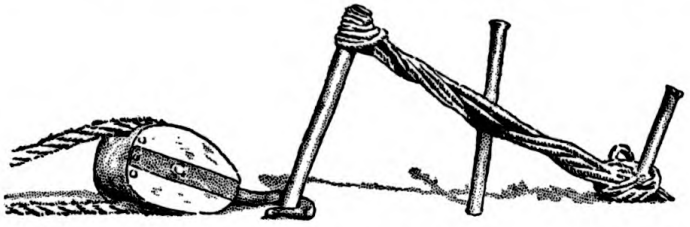


FIGURE 48.—Anchored stake.

the second, and another half clove hitch is completed over the first, wrapping the rope around below the first hitch. This lashing is completed a number of times before the rope is secured to the second stake. A third stake may then be used to twist the lashing tight, after which it is driven into the ground.

92. Night-lighting devices.—*a.* Military vehicles should be equipped with night-lighting devices for use in night operation without lights. For those vehicles not so equipped, an improvised covering may be installed to permit only a dull glow of light.

b. Luminous paints which emit a faint glow in darkness may be used to replace night-lighting devices and may also be used on panels temporarily placed on the ground to guide a unit at night.

93. Mechanical expedients.—The usual limitations for repair of the vehicle by the driver are stated in section IV. However, the following repairs can be made in the field in case of an emergency:

a. Broken spring leaves are splinted by means of strong pieces of wood or metal held in place with wire. One or several tent pins may be used. If necessary, a block of wood is secured between the frame and axle to prevent spring action. When necessary, displacement of the axle is prevented by running a wire around the front spring hanger and the axle.

b. When the light fuse is burned out, it may be temporarily replaced with tinfoil. This should be done only after the short in the system has been corrected.

c. A fan belt may be replaced with rope or the old one fastened together with wire. Friction tape may be wrapped around the belt to hold it in place.

d. When water has shorted the ignition system, it should be wiped away from the spark plugs. The wires should then be removed from the distributor head and wiped dry.

SECTION VIII

DIFFICULT OPERATIONS

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94. Points to be observed.—In difficult operations the following points should be observed:

a. The column leader should have a good driver and a vehicle in good mechanical condition.

b. On approaching doubtful crossings or steep hills, a quick reconnaissance to determine the best route is made on foot ahead of the first vehicle.

c. Guards are dropped where drivers in rear should be cautioned.

d. While moving, a driver is given freedom in the operation of his vehicle within the limits prescribed by the commander to insure safe and efficient operation of the column.

e. When a vehicle is stalled, the driver must be given advice and help. A decision is required at once as to whether or not it can be moved by the next vehicle or by men at hand. If it cannot be moved without holding up the column, it is left for the crew with the trouble truck.

f. The column must be kept moving. When the road is blocked, a new route around is immediately found for other vehicles.

95. Power, momentum, traction, and flotation.—The ability of a motor vehicle to negotiate difficult terrain depends upon its power, momentum, traction, and flotation. A proper appreciation of these related factors will assist military personnel in the choice of a practical expedient to meet most road difficulties.

a. Power in any gasoline-propelled vehicle depends primarily upon maintaining sufficient engine speed. A shift to a lower gear allows the application of more power, but with a loss of forward momentum.

b. Momentum is the energy stored up by the weight in motion of the vehicle. It increases with the speed of the vehicle.

c. Traction is the maximum wheel or track thrust that may be applied to the ground surface without slipping.

d. Flotation is the ability of a wheel or track to ride the ground surface.

96. Ascending steep slopes.—*a. Approaching normal hill.*—On approaching the usual hill, the leading driver should select a sufficiently low gear and proceed to the top without attempting to race his engine to keep up the normal rate of march. The driver of each succeeding vehicle closes up as the ascent begins and loses distance as the vehicle ahead picks up speed at the crest.

b. Approaching difficult hill.—Where the grade is slippery or the slope particularly steep, the leading driver on approaching the hill should select a sufficiently low gear and continue on to gain the maximum momentum which his load and the condition of the road permit. The driver of the next vehicle should slow up and halt before he arrives at the approach. He should wait long enough to see that the vehicle ahead has cleared the crest. The driver of each succeeding vehicle should close up, halt, and follow only after being certain that the vehicle ahead will negotiate the hill.

c. Overcoming failure.—On a steep ascent, stalling usually occurs because of either power or traction failure. Four solutions are presented: another run in a lower gear may be made; the load may be decreased or increased; traction devices may be added; or towing power may be applied.

(1) *Taking another run.*—If a driver has failed to give his vehicle the maximum momentum practical on the approach, or if a shift has been made at the last moment in an effort to increase the power, the driver is usually at fault. Another trial, with the maximum momentum practicable or with a lower gear ratio, may succeed.

(2) *Increasing or decreasing load.*—If power fails with maximum momentum and the lowest gear ratio, the load may be decreased. However, if failure is due to loss of traction and flotation is good, sufficient traction may be gained by increasing the load. This is usually done by loading men over the driving axle or axles. This solution will often be successful on vehicles with two-wheel drives, and on other vehicles not loaded but with heavy towed loads. On nontowing vehicles having front-wheel drives, the addition of more than the normal load is seldom advisable, because these vehicles will have sufficient traction to pull to the limit of their power.

(3) *Applying traction devices.*—If the road is soft or slippery, chains or other traction devices should be installed.

(4) *Applying towing power.*—Usually the most expeditious method of getting over a difficult ascent is to apply towing power, utilizing manpower, the winch, or another vehicle.

(*a*) If the hill or critical ascent is short, the use of manpower applied through prolonges is usually the quickest and most practical method.

(*b*) If the hill is long and a winch truck is available, it should go up first and then pull the other vehicles over.

(*c*) If one truck can be pulled over, a long cable or chain may be used to connect each vehicle in turn so that each helps the next over the ascent.

(*d*) Towed loads may be disconnected and pulled up separately. If necessary, several vehicles may be connected in tandem to pull up a towed load.

d. Failure precaution.—As a precaution, when a vehicle stalls on a hill, the driver should not shift gears until he has tested the brakes by disengaging the clutch gradually. After the brakes have been tested and found to hold, the driver should shift to reverse and back the vehicle down the hill or to the side of the road in gear.

97. Descending steep slopes.—Descents should be approached similarly to ascents. The following procedures should be observed:

a. Choosing descent.—Very steep slopes should be descended straight down, so that in case sliding occurs the vehicle will not get out of control. All personnel except the driver should be dismounted.

b. Braking.—Hills should always be descended in gear. The correct gear for the descent of a steep slope should be chosen during the approach and should not be changed until the bottom of the hill is reached. As a rule, the same gear is required in going down a hill as would be used in coming up the same hill. A sufficiently low gear should be selected so that the brakes need not be used. However, when necessary, brakes should be applied intermittently, being careful not to lock the wheels. In the descent of a hill, no attempt should be made to maintain the normal rate of march by racing the engine. *The ignition should not be turned off.*

c. Assistance.—Outside assistance should be given to vehicles descending steep slopes. It may be applied as follows:

(1) By manpower, through the use of prolonges or block and tackle. A rope may often be snubbed around a tree or post.

(2) By use of another vehicle on top of the hill, moving forward in lowest gear, connected by chain, cable, or rope to the vehicle descending.

(3) By use of the winch, the cable being run out in gear, the descending truck operating in the lowest gear.

(4) By setting brakes on towed loads and attaching a safety rope or tackle. When necessary, towed loads should be disconnected and let down separately.

98. Muddy roads.—The usual muddy road that will be encountered is soft and slippery on the surface, while underneath it is generally hard or will pack sufficiently to support a vehicle. Soft spots will allow spinning wheels to dig in quickly. The following procedures are applicable to negotiating this type of muddy going:

a. Traction aids.—Chains usually give the best aid to traction and prevent skidding.

b. Gear.—In general, the highest gear that will give sufficient power is selected. As the loss of momentum and the sudden application of increased power at a critical point start the wheels to spin, the need for a gear reduction must be anticipated.

c. Momentum.—Momentum should be maintained across slippery places and up grades. Usually when slipping occurs, the speed of engine should immediately be decreased so that the wheels can take hold.

d. Choice of track.—Old ruts are the hardest packed and should generally be chosen. This rule usually holds for all vehicles following. The exception to this rule is covered in paragraph 99. Where

road centers are high, ruts should be straddled or a new track should be made.

e. Procedure on stalling.—Once a vehicle has come to a complete stall in mud, the clutch is disengaged at once. No new trial is attempted until an outside check-up is made. Proper procedure for quickly extricating a stalled vehicle is dependent upon judgment and experience. The following possibilities are suggested:

(1) *Dismounting personnel.*—If personnel are carried, they should dismount and try to push the vehicle out. Often the lightened load and this applied power will be sufficient. In making a try with outside aid, the driver should apply power to the wheels gradually by easing in the clutch. This trial should not be continued to such an extent that the wheels dig in.

(2) *Selecting best way out.*—Usually a vehicle can be moved backward for a new trial easier than it can be moved forward.

(3) *Use of manpower.*—If prolonges and sufficient men are available, an immediate attempt should be made to move the vehicle by manpower.

(4) *Applying nearest suitable tow.*—If a light tow will probably succeed, the next suitable vehicle ahead or behind may be used. Often the next vehicle can be detoured and used for a tow. Where the vehicle has slid off a highly crowned road, men with prolonges attached to the sides may assist in helping the vehicle back onto the road.

f. Stalled vehicle.—(1) Where the vehicle is found to be hopelessly stalled, a winch, tractor, vehicles in tandem, or a block and tackle must be used.

(2) Where a vehicle operating alone becomes stalled in mud, the driver and any personnel that may be with him are dependent on one of the following methods of extricating it:

(*a*) *Improving traction.*—Any additional traction devices, such as wheel mats, lug plates, or grouser ropes may be applied. Often one or more drive wheels must be jacked up and traction and flotation increased by placing brush, boards, rocks, or similar material under the wheels. When possible, a pole used as a lever inserted under the hub or in place of the wheel cap is the easiest method of raising the wheels.

(*b*) *Digging out.*—Ditches dug in the direction that the wheels are expected to move assist in moving the vehicle out. When wheels are in deep ruts, usually cross ditches dug at an angle to the ruts with dirt thrown into the ruts are necessary to carry the wheels back on to a straddle position over the rut.

(*c*) *Windlass method.*—The windlass method of having a dual-wheel truck pull itself out of a bad mud hole is simple and rather cer-

tain of success. A single, long cable with loops on each end, or two tow cables, and four stakes are required. The vehicle may be pulled out either backward or forward. Two anchored stakes are installed on the bank at the same distance apart as the wheels and directly in front of or behind the vehicle. The loop ends of the cables are taken in between the tires of each dual wheel and secured by passing the loop between the spokes and over the hub. The cables are then attached to the anchor stakes. The vehicle is then pulled out on its own power by allowing the cable to wind up between the dual wheels whenever slipping occurs.

(*d*) *Pole method.*—A similar procedure may sometimes be followed by inserting a pole as a track between the dual wheels that are slipping. This method may be made more efficient with track-laying vehicles by attaching the pole to the track. The vehicle is rolled over it and the attachment is removed before strain is placed on the track.

Caution: Because of the danger of slipping under the vehicle, personnel should be cautioned against pushing on the side of a moving vehicle that has slipped into the ditch from a high crown road or on a vehicle that has slipped into old wheel ruts.

99. Swampy or boggy ground.—Where water has been standing for a considerable time and swamp grass has grown, a surface crust has formed on top of a bottomless soil. Certain variations in rules and procedure apply in this exceptional type of muddy going:

a. Avoiding swamps.—Boggy or swampy soil may usually be avoided. Every effort should be made to move over the highest ground available.

b. Traction devices.—The addition of dual wheels in front, traction bands, and any other aids which increase the wheel surface in contact with the ground are a distinct advantage.

c. Personnel dismount.—Personnel should dismount and assist with prolonges at critical points.

d. Maintaining momentum.—The main requirement in moving over a boggy piece of ground is to move over it rapidly without stopping. Wheel spinning should be kept at a minimum.

e. New tracks selected.—The grassy crust may carry one vehicle but may not support another in the same track. Therefore each vehicle should follow a separate track. A guide should precede each vehicle on foot, locating the hard ground and guiding the driver carefully over the best route.

f. Stalling.—When a vehicle comes to a traction stall, the clutch should be disengaged at once. No attempt should ever be made to move it without outside power.

g. Towed loads.—To pull towed loads, several trucks may sometimes be hooked in tandem; or they may be pulled abreast, with the towed load attached by a pulley sliding on a cable between the two trucks.

100. Gumbo and other sticky soils.—Gumbo and other sticky soils present a problem similar to that of boggy ground. In addition these soils give little traction and stick to the tires and wheels in great masses. Boards, shovels, knives, and the like may be fastened to cut the mud from the wheels. Whenever possible, old hard-packed roads should be selected through these areas.

101. Passing through sand.—Flotation in sand increases more or less below the surface. Usually sand will support a vehicle moving rapidly. However, traction is very limited because wheels are continually slipping. As soon as a drive wheel begins to spin it digs in fast. Although the difficulties in passing through sand vary between those described in paragraphs 98 and 99, several additional procedures are possible in overcoming traction failures in sand:

a. Increasing tire surface.—In exceptional circumstances air pressure may be decreased in the tires to give sufficient flotation.

b. Digging vehicle out.—When the sand is somewhat encrusted below the surface, the vehicle will continue to creep while the wheels spin. As long as the vehicle continues to move, the wheels may be kept slowly spinning, allowing the vehicle to dig itself out.

c. Using same track.—In order to reduce road friction, vehicles should follow exactly the tracks of the vehicle ahead.

d. Making roads.—Hog or chicken wire fencing staked on the surface of sand will usually make a satisfactory surface for movement of motor vehicles.

102. Driving on snow and ice.—On soft snow, flotation is at a minimum, while on ice, traction is at a minimum. In addition to many of the procedures already listed, the following are applicable to winter driving:

a. Traction aids.—Chains on all wheels are usually the best safeguard in normal winter driving. However, on ice they add little or no traction and are apt to give a false feeling of security, because they increase skidding.

b. Moving over fresh snow.—When breaking freshly fallen snow, manpower should be readily available to push the first vehicle or to tow it with prolonges where the snow is deep. Other vehicles, following exactly in track, usually move under their own power if they are able to gain momentum in approaching difficult slopes and crossings.

c. Braking.—The engine should be used as a brake. The driver shifts to a lower gear when more braking power is needed. When used, brakes should be applied lightly and released quickly if skidding begins.

d. Accelerating.—Rapid acceleration should not be attempted, as it may cause one drive wheel to spin, thus losing traction or causing skidding.

e. Overcoming skidding.—If skidding occurs, the brake or clutch should not be touched. The accelerator should gradually be released. The front wheels are turned in the same direction the hind wheels are skidding, so that the vehicle will be carried forward with momentum in a straight line parallel to its original path.

f. Holding vehicles on road.—Where necessary, men with prolonges may hold vehicles on dangerous icy roads.

103. Crossing ditches and deep ravines.—*a. Narrow or shallow ditches.*—Ditches in width up to nearly the diameter of the tire and wider shallow ditches should always be traversed at an angle, so that the drive wheel on one side will take hold of the far edge of the ditch at the same time that the opposite wheel is going into it. As this angle of crossing is a severe strain on the frame, springs, and driving mechanism, personnel should be dismounted to assist by pushing at the critical point. Ditches must be crossed slowly.

b. Wide ditches or ravines.—When a ditch is wider than the diameter of the tire and deeper than the running board or undercarriage clearance, no attempt should be made to pass it until the banks are thrown in and the bottom filled up. Such ditches should be crossed at right angles. If they are wet, they should be approached slowly and the vehicle speeded up without wheel slipping just as the front wheels cross the lowest point.

104. Fording shallow streams.—Fordings should be attempted only after careful reconnaissance. The following points are to be observed:

a. Cross slowly.—As a rule nothing is to be gained by attempting to use momentum in crossing streams. They should be crossed slowly in a low gear.

b. Disconnect fan.—If there is any danger of the water surging or splashing to the fan, it should be disconnected for the crossing, usually by loosening a bolt and raising the generator.

c. Dry brakes.—After crossing a stream brakes should be applied intermittently until dry enough to hold.

d. Check lubrication.—At the first opportunity wheels, crankcase, universal joint, differential, transmission, and subtransmission should be checked for proper lubrication.

105. Deep-stream crossings.—When the situation demands that streams too deep for fording be crossed, the first consideration should be to obtain ponton bridges, bridging materials, ferries, or rafts. However, even if none of these are available, motor vehicles can be taken across streams of almost any depth without serious damage if suitable precautions are taken. The tackle and tow indicated in figure 49 are used. The vehicle must be properly prepared for submersion by closing all openings and removing such parts as will be seriously harmed or rendered inoperative by moisture. After crossing, the vehicle should be thoroughly serviced and water removed from units.

106. Bridges.—Speed caution signs should be carefully observed, as well as the signs showing maximum capacity. When the capacity

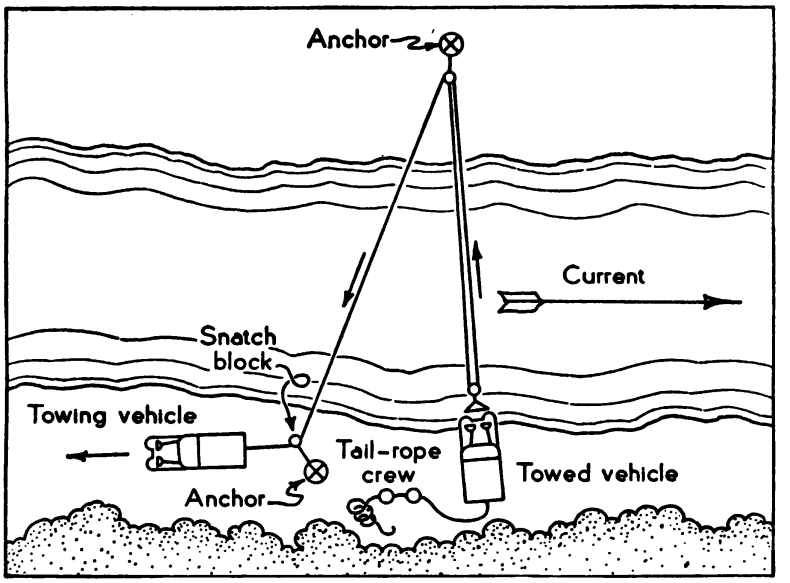


FIGURE 49.—Tackle for deep-stream crossing.

of a bridge is not sufficient, the towed load should be pulled across separately. Track-laying vehicles should be started across a bridge so that they will not have to be turned, because steering them places a severe strain on the bridge.

107. Driving on curves.—Skidding on slippery curves is avoided by a reduction of speed before the vehicle goes into the turn. The importance of this consideration depends upon two factors:

a. Centrifugal force, which tends to throw a vehicle to the outside of a curve, varies as the square of the speed.

b. When the brakes are applied, the weight of the load is shifted from the rear wheels to the front wheels, reducing the traction on the rear wheels and increasing the tendency to skid. When the

brakes on a towed load are not applied, the tendency to skid is increased.

108. Negotiating turns with towed load.—If a curve is too sharp for a truck and towed load, it is usually possible to uncouple the truck and drive it around the turn, and then by use of a tow cable or block and tackle to pull the towed load around the turn.

109. Righting an overturned vehicle (fig. 50).—In order to

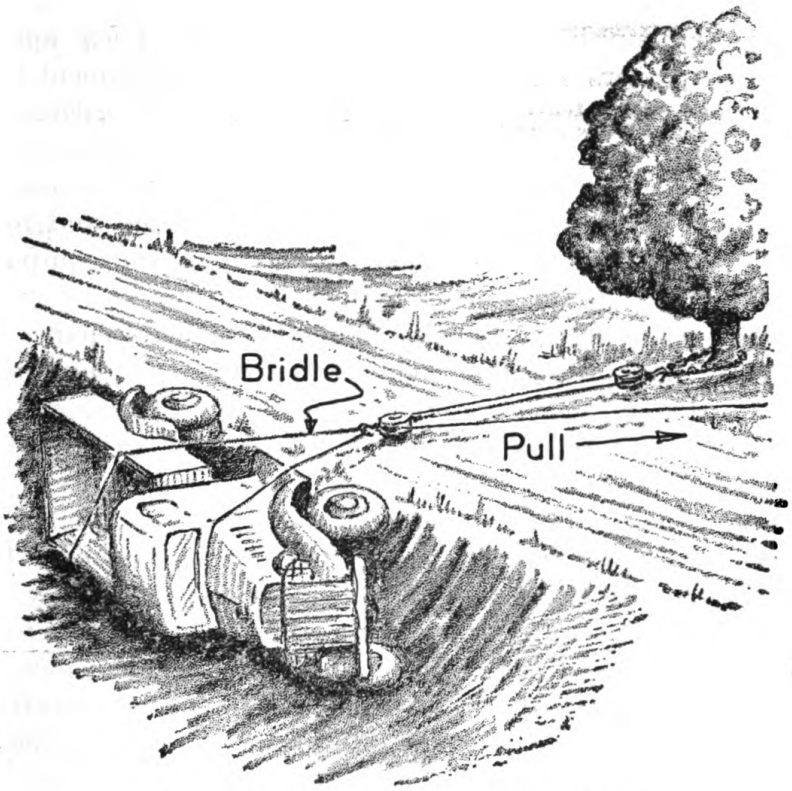


FIGURE 50.—Righting an overturned vehicle.

get a maximum leverage on an overturned vehicle, a cradle of two ropes should be passed over the body of the vehicle, one in front of the windshield and the other in rear of the center of the vehicle. Both should preferably be tied to the body frame or spring shackle Brakes should be applied before the vehicle is righted Any of the towing means may be used on the ropes. Holding lines should be used to prevent damage to the vehicle from settling too rapidly. Before the vehicle is moved under its own power, necessary oil, gas, and battery and radiator water should be replaced, and a careful inspection should be made to determine the damage done.

SECTION IX

ECHELONS OF MAINTENANCE

Paragraph
First echelon—driver and assistant driver 110
Second echelon 111

110. First echelon—driver and assistant driver.—The first echelon maintenance is drivers' maintenance. It covers the simple operations that can be trusted to the skill of the average driver using tools and supplies available on the vehicle. These operations may include: drivers' inspections; servicing (replenishment of gasoline, oil, water, antifreeze, and air); cleaning, lubrication, except items requiring special lubricants, equipment, or technical knowledge; tightening or replacement of nuts, bolts, screws, and studs; preparation of the vehicle for maintenance operations and for command and technical inspections; and care of tools and equipment of the vehicle to include the storage battery.

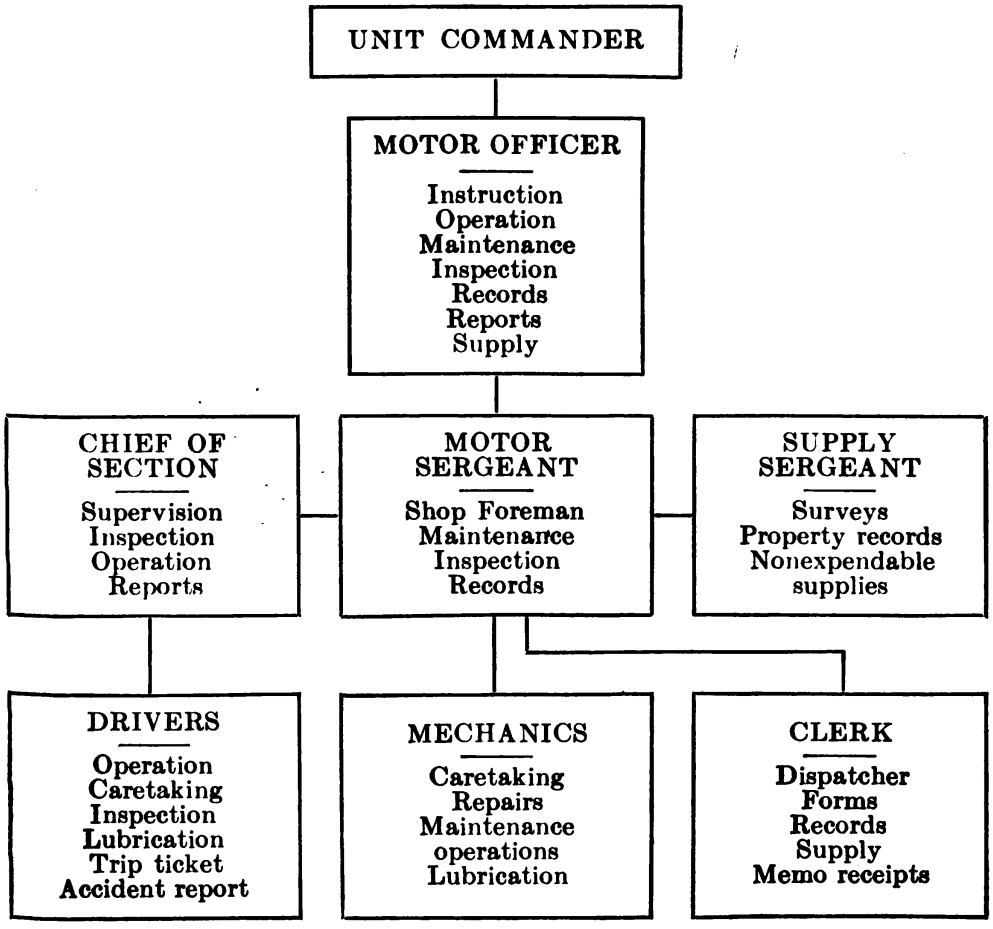
111. Second echelon.—The second echelon maintenance is that maintenance other than first echelon maintenance performed by the using arms and services. It embraces preventive maintenance, minor repairs, unit replacements, and inspections within the limits of time available. When vehicles are pooled or are in one special organization, the first and all the second echelon functions are combined On the other hand when a battery of a regiment has vehicles assigned to it, the second echelon functions are usually divided between the battery and the regiment. The organization to which the vehicles are assigned is responsible for first echelon maintenance and certain portions of the second echelon, limited as hereafter provided by the tools, light portable equipment, parts, and mechanics authorized. The regiment, on the other hand, with its separate maintenance section, performs the operations requiring either more skill or special tools

a. Battery.—(1) *Unit.*—(*a*) The unit is directly responsible for the first and part of or all the second echelon maintenance. The success of preventive maintenance will depend upon the judgment, energy, common sense, and ability not only of that unit commander but also of his subordinates. The state of training, discipline, and morale of the latter also will have a direct bearing upon operating efficiency. In order to insure a high state of operating efficiency the unit must—

1. Separate, so far as possible, the operating and maintenance functions of the personnel and establish definite responsibility for each function.

2. Establish and maintain uniformly high standards for all work.
3. Make vehicles available for maintenance operations.
4. Enforce a simple but thorough method of record keeping.
5. Conduct schools to insure uniform training of drivers and mechanics and to supply replacements for personnel losses.
6. Provide necessary lubrication, maintenance, and inspection guides.
7. Establish and enforce routine scheduled maintenance operations.
8. Have such inspections as are necessary to insure the proper coordination and functioning of all personnel.

ORGANIZATION WITHIN THE BATTERY FOR SECOND ECHELON MAINTENANCE



(*b*) Continued successful operation by a motorized unit requires that the personnel give to the activities of maintenance the time and

effort necessary to meet the needs of operation. Unusual operating efforts require unusual maintenance efforts if the command is to retain its efficiency in movements. In unusual conditions, provisions are made to divide the work into shifts so that the maintenance personnel may have an opportunity for rest. A practical division of duties and responsibility is given in (2) to (5), inclusive, below.

(2) *Motor officer.*—The motor officer is selected from those officers having either special motor training or aptitude. He should be familiar with all the peculiarities of his vehicles and should be able to inform his seniors at any time of the exact condition of each vehicle. He is responsible to his immediate commander for the technical operation and maintenance of the vehicles. His duties include—

(*a*) Organizing and supervising the maintenance, repair, and servicing of vehicles.

(*b*) Instructing the drivers and assistants until they are fully qualified.

(*c*) Being in charge of all caretaking.

(*d*) Inspecting before leaving park, on the road, at the halt, at the end of the march; inspecting vehicles in storage; and maintenance inspections.

(*e*) Assisting in making command inspections.

(*f*) Seeing that all parts and supplies are procured.

(*g*) Routing vehicles to a higher echelon.

(*h*) Supervising the keeping of forms and records.

(*i*) Instructing all maintenance personnel in their duties.

(*j*) Spot checking all maintenance operations.

(*k*) Carefully watching the lubrication services and checking the lubricants for type and condition.

(*l*) Having all fire hazards removed.

(*m*) Observing the drivers, whenever practical.

(*n*) Directing the transfer of loads in case of break-down.

(*o*) Giving proper instruction in case any personnel is left behind on a march.

(*p*) Giving proper instructions to expedite any road repair or rescue.

(*q*) Riding usually at the tail of the column.

(3) *Motor sergeant.*—The motor sergeant is selected for his knowledge, mechanical skill, and his aptitude for organization and supervision. He allots the work to mechanics and inspects their work both during the actual performance and when the job is completed. He should be well versed in quickly and accurately diagnosing mechanical failures and should be able to give the mechanics proper instructions for corrective action. He should be trained in field

expedients and should be able to get the vehicles through when stalled or in bad going. He should be present with the vehicles from the time of the arrival of the first driver until the last vehicle is in, and he should remain with them until they are all ready to operate again. His duties include—

(*a*) Principal assistant to motor officer.

(*b*) Direct charge of the park.

(*c*) Directing the work of mechanics and, if so assigned, the drivers.

(*d*) Closely supervising and checking the work of mechanics in scheduled maintenance.

(*e*) Assisting, as directed, in inspections.

(*f*) Observing operation of vehicles on the march, and supervising road adjustments, repairs, and rescues of stalled vehicles.

(*g*) Personally checking or designating a mechanic to check all vehicles immediately upon any halt and upon completion of the day's march. Particular attention is paid to excessively heated parts, such as gears and brakes.

(*h*) Reporting evidences of neglect, abuse, or carelessness to the motor officer.

(*i*) Keeping or supervising the keeping of the record of repairs, adjustments, fuel, and supplies.

(*j*) Supervising starting of engines to see that they start promptly and are warmed up properly.

(*k*) Riding usually at the tail of the column.

(4) *Chiefs of sections.*—Chiefs of sections direct the march of their sections and require drivers to comply with instructions as to gear, speed, distances, safety, and similar matters. Their duties include—

(*a*) Responsibility for and directing caretaking by drivers.

(*b*) Reporting vehicle troubles and faults to the motor sergeant.

(*c*) Responsibility for the replenishment of gasoline, oil, water, and other operating supplies.

(*d*) Riding usually in the first vehicle of the section.

(5) *Mechanics.*—The number of mechanics allotted to the various units is given in the Tables of Organization. It is based on the number of vehicles to be maintained. Mechanics make repairs and adjustments under the direction of the motor sergeant. They perform the operations of scheduled maintenance, assist chiefs of sections in caretaking when so detailed, and observe vehicles on the march. One mechanic usually rides with the motor officer and the others ride in the unit repair truck.

(6) *Tools and equipment.*—The Tables of Basic Allowances prescribe the tools and equipment. For each general automobile

mechanic the allowance is one set of hand tools consisting of about fifty items. Included are a canvas tool bag; box end, engineer, pipe, socket, and crescent wrenches; hammers; punches; screw drivers; files; drifts; feeler gage; chisels; pliers; and several other items. This set is issued to each mechanic on memorandum receipt from the unit supply sergeant; the mechanic should carry his set of hand tools with him wherever he is required to ride. In addition to the tool sets of the mechanics, the motorized battery or similar unit is allowed a "unit equipment set." Other "unit equipment sets" are available for issue to second echelon units if provided for in the Tables of Basic Allowances. A "mechanic's truck" or repair truck is usually allotted to each unit for carrying mechanics, tools and equipment, and parts and operating supplies.

(7) *Spare parts and supplies.*—In order to prevent the dissipation of spare units and parts, the stock is generally limited to that required for the discharge of necessary maintenance functions. The stock required will vary with the number, makes, and types of vehicles as well as with the conditions of operation, such as cold, dust, sand, and mud. Parts and supplies of the following type are usually stocked and carried: spark plugs, condensers, fuses, lamps, fan belts, ignition cable, radiator hose and clamps, miscellaneous gaskets, gas and oil lines and fittings, battery cables, lubrication fittings, water-pump packing, gas tank and radiator caps, and assorted hardware, to include bolts, nuts, washers, pins, and screws.

b. Regiment.—In most arms and services there is provided by the Tables of Organization a regimental second echelon maintenance organization. The personnel are a part of the headquarters battery or like unit of the regiment and are administered by the commanding officer of that unit. Normally the Tables of Organization provide a regimental motor officer, regimental motor sergeant and assistant, motor supply personnel, general automobile mechanics, and a clerk. When all the vehicles of the regiment are physically pooled and all maintenance functions are performed by the regimental second echelon, additional personnel, such as dispatcher, truck masters, and extra mechanics, will normally be provided. The organization is generally such that the personnel as well as tools, equipment, and supplies are readily decentralized into battalion sections in case such decentralization becomes necessary.

(1) *Regimental motor sergeant.*—The regimental motor sergeant is the principal assistant of the regimental motor officer. He is in direct charge of the mechanics and assigns and supervises their work. He coordinates the duties of the supply personnel with those of the maintenance personnel. He prepares the maintenance records and

reports required. In the absence of the regimental motor officer, he takes over his duties, establishes the maintenance set-up in the field, and notifies all organizations of his location.

(2) *Regimental motor mechanics.*—The regimental motor mechanics should be among the best-qualified mechanics in the regiment, thus making the services of the best mechanics available to all units.

(3) *Tools and equipment.*—Tools and equipment allotted regimental maintenance units are prescribed in the Tables of Basic Allowances. Each mechanic is allotted a set of hand tools of the same type as are furnished battery mechanics. Each regimental section or platoon is allowed one or more "unit equipment sets." In general, these sets include the same items as are allowed the battery or similar unit, plus tools and equipment for more extensive and technical operations.

(4) *Spare parts and supplies.*—The bulk of the spare units, parts, and supplies for the entire regiment is carried in the regimental section or platoon. This prevents dissipation of the stock available and yet allows any portion of it to be readily available to the organizations. The stock required will vary with the number, makes, and types of vehicles, as well as with the conditions of operation. The supply of parts, units, and supplies requires careful planning and close cooperation with the supply agencies to insure the prompt service necessary for efficient operation. Ordinarily an unserviceable unit is replaced by a spare unit, if one is available, and the damaged unit is then returned by the regiment to the third echelon for exchange. The authorized stock of maintenance and operating supplies should at all times be available in the second echelon. In addition to the parts and supplies usually carried in the battery or similar unit maintenance establishments, the regimental maintenance platoon carries accessory assemblies and certain other high-mortality parts.

SECTION X

RECORDS AND REPORTS

Paragraph
Reports and records required by regulations 112

112. Reports and records required by regulations.—*a. Driver's Report—Accident, Motor Transportation (Standard Form No. 26).*—This form will be carried on every military motor vehicle.

b. U. S. Army Motor Vehicle Operator's Permit (W. D., Q. M. C. Form No. 228).—This permit must be in the possession of the vehicle operator at all times when he is operating the motor vehicle (pars. 75 and 76).

c. Motor Vehicle Technical Inspection Report (W. D., Q. M. C. Form No. 260).—This form will be used in recording the technical inspections required by AR 850–15.

d. Driver's Trip Ticket and Performance Record (W. D., Q. M. C. Form No. 237).—No vehicle will be dispatched unless a trip ticket accompanies the vehicle. Drivers should be required to complete the form in full detail. These forms provide information required in the vehicle service record books. It is sometimes more convenient to make up a form for local use.

e. Motor Vehicle Service Record Book (W. D., Q. M. C. Form No. 248).—This record will be kept for every quartermaster motor vehicle in operation. It constitutes the service record of the vehicle and will be transferred with it. Instructions relative to the posting of this record are contained in the book itself. This is a most important record and must be accurately and promptly posted.

Appendix I

CHECK SHEET FOR PRACTICAL EXAMINATION OF DRIVER

Name_____ Organization_____

ATTENTION AND OBSERVATION:
____Excessive talking and visiting.
____Fails to follow instructions.
____Fails to keep eyes on road ahead.
____Fails to look both ways at railroad crossing.
____Fails to look left at intersection.
____Fails to look right at intersection.
____Mirror positions not checked.
____Misinterprets sign.
____Misses red light.
____Misses stop sign.
____Sees signs late.

ATTITUDE:
____Annoyed by other drivers.
____Annoyed by pedestrians.
____Bluffs other drivers.
____Easily excited.
____Excessive use of horn.
____Hesitant.
____Honks at pedestrians in cross walk.
____Impatient in heavy traffic.
____Loses temper.
____Overly cautious.
____Show-off and overconfident.
____Violates other drivers' right of way.
____Violates pedestrians' right of way.

BRAKING AND STOPPING:
____Bumped by car behind.
____Bumps car ahead.
____Depresses clutch before brake in high.
____Excessive braking on straightaway.
____Fails to signal in ample time for stop.
____Jerks passengers.
____Kills engine.
____Light turns red while in intersection.
____Looks to find hand brake.
____Races motor.
____Stop not complete at stop sign.
____Stops over cross walk.

BACKING:
____Backs too fast.
____Clashes gears.
____Excessive use of brakes.
____Fails to look if road is clear.
____Opens door to look back.
____Steering uncertain—sudden reversals.

CAR CONDITION:
____Brakes defective.
____Lights defective.

STARTING CAR ON LEVEL:
____Delays too long on "green."
____Excessive acceleration.
____Fails to look in all directions.
____Jerks car when starting.
____Kills engine.
____Leaves hand brake on.
____Races motor.
____Starts on amber.

STARTING CAR ON UPGRADE:
____Car rolls back over 6 inches.
____Jerks car.
____Kills motor.
____Races motor.

SPEED CONTROL:
____Brakes on curves.
____Coasts down hill in neutral.
____Erratic—feeds gas by spurts.
____Excessive at blind corners.
____Excessive at intersections.
____Excessive in approaching railroad.
____Exceeds speed limit.
____Fails to observe slow signs.
____Passengers feel uncomfortable.
____Speeds up when being passed.
____Tires screech on curves.

APPENDIX

LEAVING CAR:
____Fails to lock truck.
____Fails to set hand brake.
____Motor left running.
____Parks improperly.

PARKING:
____Backs more than twice.
____Fails to give signal when stopping.
____Fails to set hand brake.
____Goes over curb or bumps hard.
____Hits car behind too hard.
____Hooks bumper of car ahead.
____Leaves less than 2 feet between cars.
____Parks in illegal space.
____Requires over 1 minute to park.
____Slides tires on curb.
____Tires over 6 inches from curb.
____Wheels turned improperly on hill.

POSTURE:
____Both hands not on wheel.
____Elbow rests on window.
____Hands in awkward position on wheel.
____Looks through steering wheel.
____Seat improperly adjusted.
____Sits in tense position.
____Slumps in seat.

PASSING AND FOLLOWING:
____Cuts in too soon after passing.
____Fails to signal car ahead.
____Fails to signal car behind.
____Follows too closely.
____Forces oncoming car to slow down.
____Goes too close to vehicle passed.
____Insufficient room ahead when passing.
____Passes on curve.
____Passes on hill crest.
____Passes on wrong side.
____Passes to left of street car.
____Passes within 100 feet of intersection.
____Pulls up and changes mind.
____Requires over 10 seconds to pass.
____Swings out too wide when passing.

PULLING FROM CURB:
____Fails to give signal.
____Fails to look in both directions.
____Hits parked cars.
____Interferes with passing cars.
____Pulls out too far in street.
____Pulls out too fast.

STEERING:
____Crosses center line unnecessarily.
____Drives off roadway.
____Drives through loading zone.
____Drives too close to parked cars.
____Hits object.
____Shifts too rapidly between lanes.
____Sideswipes car or object.
____Steering sudden and jerky.
____Straddles marked lanes.

TURNING:
____Cuts corner too sharply.
____Fails to signal left turn.
____Fails to signal right turn.
____Hits curb.
____Late in getting into proper lane.
____Signals too late or too briefly.
____Stops through traffic during left turn.
____Swings too wide.
____U-turn—hits curb.
____U-turn—interferes with traffic.
____U-turn—stops more than once.

Appendix II

WRITTEN EXAMINATION OF DRIVER

Place a check in column "T" if the statement is true; in column "F", if false.

T	F	
		1. Racing an engine to warm it up is advisable.
		2. The hand brake should be set when motor is started.
		3. The clutch should be disengaged when the motor is started.
		4. Color blind test should be given to each driver before a permit is issued.
		5. While driving, the right foot rests on the accelerator and the left foot on the clutch pedal.
		6. Driver inspects for leaks under motor by crawling under vehicle while engine is running.
		7. Driver is responsible for tightening all loose bolts and nuts.
		8. Driver inspects for loose and broken parts before washing vehicle.
		9. In case a person is overcome by carbon monoxide gas he should be removed from gassed building and given a stimulant.
		10. Traction devices should be placed on wheels before moving out of motor park in muddy weather.
		11. If oil pressure gage shows zero, it should be reported after reaching motor park.
		12. Driver checks panel instruments only before and after operation.
		13. Drivers use only two types of lubricants: chassis and oil.
		14. In case of emergency, driver applies pressure enough to lock all brakes.
		15. The service brake is applied by hand.
		16. Driver should disengage clutch while descending grades.
		17. All vehicles should pull to side of road when siren is heard.
		18. Left turns are made from right lane.
		19. Signal for right turn is: arm straight out.
		20. Battery water level recommended is: cell filled up to filler cap.
		21. Sediment bowls should be removed and cleaned daily.
		22. Driver's Accident Report should be made immediately upon returning to the motor park.
		23. Wheel-bearing grease is soluble in water.
		24. Water-pump grease is soluble in water.
		25. Most accidents occur at intersections.
		26. It is better to make no arm signal at all than a poorly executed one.
		27. It is very essential in using the winch that the line be kept tight at all times.
		28. The monthly (1,000-mile) inspection is made by the driver.
		29. Servicing of the vehicle is the responsibility of the motor sergeant.
		30. A cause of crankcase dilution is overchoking.
		31. It is recommended that trip tickets be turned in weekly.

APPENDIX

T	F	
____	____	32. All the following are responsible for vehicle lubrication: driver, chief of section, mechanic, motor sergeant, motor officer, battery commander.
____	____	33. When mounting dual tires, the worn tires should be placed on the inside.
____	____	34. A driver starting in convoy always signals by extending the left arm outward and upward when his vehicle is ready to move.
____	____	35. A driver is not personally liable when driving a Government vehicle.
____	____	36. A driver of a military vehicle does not have to comply with local traffic regulations.
____	____	37. Any member of the United States Army is authorized to drive a military vehicle.
____	____	38. For economical operation, it is permissible in the Army to mix different makes of lubricants.
____	____	39. A military driver may use gasoline to clean his engine.
____	____	40. A military vehicle is never moved until the engine has reached the proper operation temperature.
____	____	41. A military driver is responsible that his vehicle tools are always present, complete, and in serviceable condition.
____	____	42. A military driver, after discovering a mechanical condition injurious to further operation of his vehicle, will continue in convoy unless ordered to fall out by higher authority.
____	____	43. A military driver is responsible that the load of his vehicle does not exceed the rated capacity.
____	____	44. A military vehicle is backed without signal when no men or vehicles are observed in the vicinity.
____	____	45. A military driver should always know his destination and route before leaving the motor park.
____	____	46. It is not essential that military drivers have a practical knowledge of map reading.
____	____	47. Correct tire pressure can be satisfactorily determined by kicking the tire.
____	____	48. If a driver is careful, it is not necessary to plug holes in the battery cell filler cap when washing top of battery with soda water.
____	____	49. Arms crossed in front of body is the signal for cranking motors.
____	____	50. Dual tires should be inspected at each halt and objects wedged between tires removed immediately.

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[A.G. 062.11 (2-7-41).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

E. S. ADAMS,
Major General,
The Adjutant General.

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